

---

This is a reproduction of a library book that was digitized by Google as part of an ongoing effort to preserve the information in books and make it universally accessible.

Google™ books

<https://books.google.com>







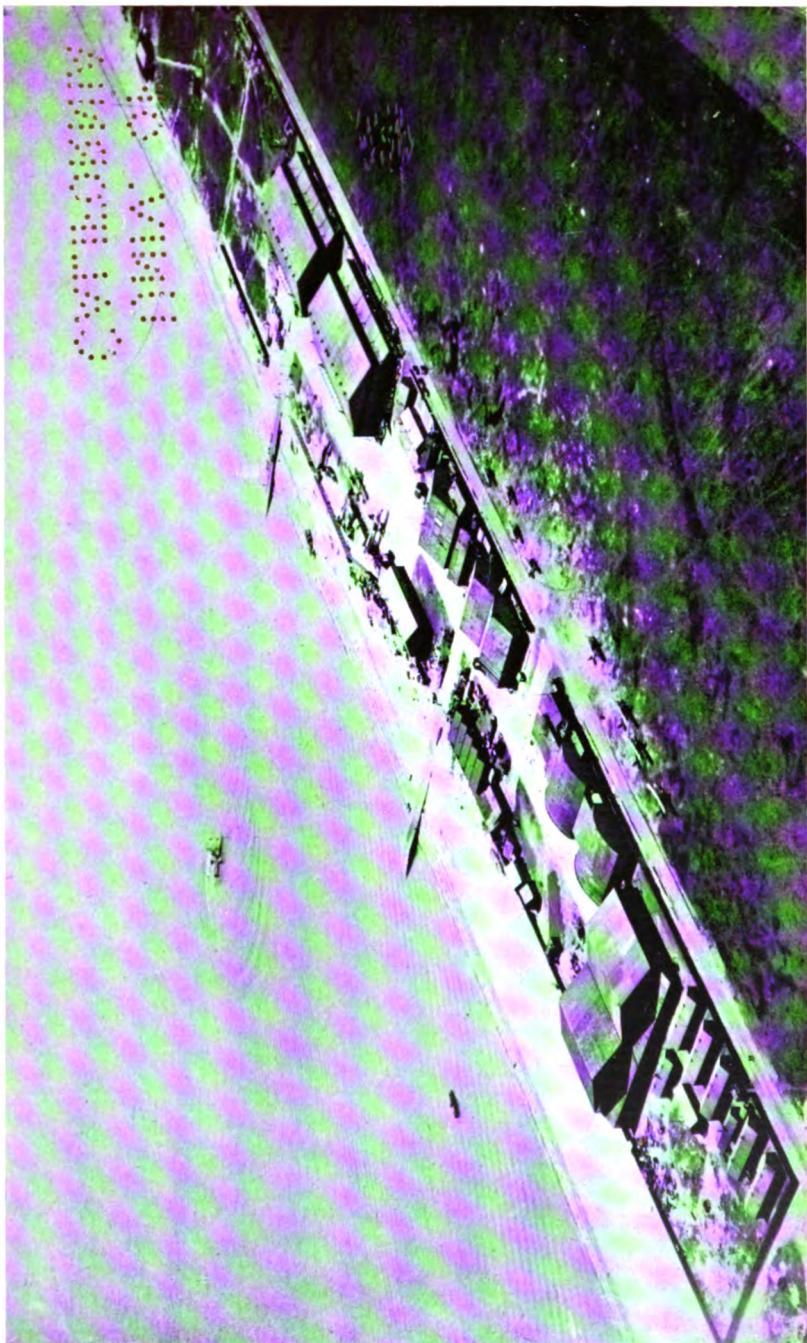




**THE STORY OF A  
NORTH SEA AIR STATION**

OXFORD  
UNIVERSITY PRESS  
LONDON: AMEN HOUSE, E.C. 4  
EDINBURGH GLASGOW LEIPZIG  
COPENHAGEN NEW YORK TORONTO  
MELBOURNE CAPE TOWN BOMBAY  
CALCUTTA MADRAS SHANGHAI  
HUMPHREY MILFORD  
PUBLISHER TO THE  
UNIVERSITY

53  
33  
23  
13



THE ROYAL AIR FORCE STATION, GREAT YARMOUTH, IN THE SUMMER OF 1918.

# THE STORY OF A NORTH SEA AIR STATION

BEING SOME ACCOUNT OF THE  
EARLY DAYS OF THE ROYAL FLYING  
CORPS (NAVAL WING) AND OF THE  
PART PLAYED THEREAFTER BY THE  
AIR STATION AT GREAT YARMOUTH  
AND ITS OPPONENTS DURING THE

WAR 1914-1918

BY C. F. SNOWDEN GAMBLE

*The Past is always entertaining . . .*

ALOYSIUS HORN

OXFORD UNIVERSITY PRESS  
LONDON : HUMPHREY MILFORD  
1928

D602  
S6

PRINTED IN GREAT BRITAIN

NO. 11901  
AUSTRALIA

*To the Memory of*

THE OFFICERS, NON-COMMISSIONED OFFICERS  
AND MEN OF THE BRITISH FLYING SERVICES WHO,  
LIVING, GAVE OF THEIR BEST, AND WHO, DYING,  
GAVE THEIR ALL—

*this Volume is Dedicated*

*'These laid the world away; poured out the red  
Sweet wine of youth; gave up the years to be  
Of work and joy, and that unhoped serene,  
That men call age.'*

RUPERT BROOKE

Typewritten



## PREFACE

THE origin of this book lay in the desire of a number of officers and men who served at Great Yarmouth air station during the War of 1914-18 to have some permanent record of the activities at this station in a conveniently accessible form, in view of the fact that these played a considerable part in combating the menace of the Zeppelin airship, as well as disputing the efforts of the Imperial German Naval Air Service to establish an aerial supremacy over the North Sea.

In the beginning it was the intention that the story be purely for private circulation amongst those who had been directly connected with the duties, but when the subject was examined in detail, and in that perspective that Time provides, it occurred to many of those interested that such a record might prove of value to a wider circle. In consequence it was decided to prepare the volume for general publication, although this course was not sanctioned without considerable opposition by many concerned, who felt that any story of this work with which they had been connected would be regarded by some as of the nature of advertisement, to which they had the confirmed Service objection.

In the interests of historic truth, of accuracy, and of fairness, it was felt that the achievements of our former opponents should be given prominence with our own, and the author has tried to obtain from reliable German sources as much information as practicable, and he wishes to express his appreciation of the help and invariable courtesy and consideration shown to him by the Director of the Naval Archives, Berlin (Vice-Admiral E. von Mantey), and also by a large number of officers formerly of the Imperial German Navy.

The story, as it now stands, is an attempt to trace the growth of the aerial arm in the Royal Navy and in the Imperial German Navy from 1908 to 1918—using the activity of one particular air station as a background. It is recognized that this method

has its disadvantages, as it is, of course, not possible to treat fully in this way all sides of the development.

The author has drawn his information mainly from accounts supplied to him by officers and men, both British and German. When so many have assisted it is perhaps invidious to particularize, but the author feels indebted especially to two of his brother officers, Major Egbert Cadbury, D.S.C., D.F.C., and Captain S. J. Fetherston, D.F.C.; to his friend, Mr. C. G. Grey; to Captain Joseph Morris, to Mr. J. C. Nerney, and to Mr. C. Colgrave for their help in so many ways and for so much kindly advice.

Of the numerous authorities which have been consulted the author desires to acknowledge the extensive use he has made of *The War in the Air, Naval Operations, The German Air Raids on Great Britain, 1914-1918, The World Crisis, and The Beginnings of Organized Air Power.*

Of the many officers, lately of the Imperial German Navy, who have helped, the author is particularly grateful to three former Zeppelin airship officers, Kapitänleutnant a. D. Joachim Breithaupt, Oberleutnant d. R. a. D. Ernst A. Lehmann, and Oberleutnant a. D. Richard Frey, and also to Oberleutnant a. D. W. von Gronau and Oberleutnant d. R. a. D. Christiansen, both of whom were seaplane pilots.

The author's thanks are due to Mr. Leonard Bridgman (formerly an officer at Great Yarmouth air station) for the drawings which he has made, from which copies have been made for use in this book.

Some explanation is perhaps necessary for the variety which will be found in the titles of particular officers and men. During the War promotion was rapid, so that the rank prefixed may be different on one page and another; therefore, when describing a particular deed the rank held by the actor at the time of its performance is given.

The work of chronicling the deeds of one's friends and of one's former opponents is no light task. One record may err by excess and the other by deficiency, and neither is permissible. Further,

a story of this kind, even were it done by one far more able than the writer, must of necessity have many limitations, but it is hoped that it will be read with a charitable understanding. The stage shows the players, 'they have their exits and their entrances', they perform their deeds and take the applause. That, however, which they did was rendered possible only by the labours of others whose part is too often ignored. Few activities depend more for success upon careful preparation in every way than that of the adventurer in the air, particularly when these activities are applied to the purposes of war. In this preparation many take their part, and to these honour is due. In the Services none know this better, or admit it more freely, than those who receive the palms; for their deeds, their successes, are the culmination of the efforts of all, even as their pains and deaths are part of the common sorrow. Nor should it be forgotten how great and how unselfish an effort was made to achieve success by many in civilian life when engaged in the work of 'supply' whose names will never be known, but whose labours were made for one end—the end desired by all.

C. F. S. G.



## CONTENTS

<b>INTRODUCTION. The Early Days of Aviation in the Royal Navy</b>	<b>1</b>
I. The Commissioning of Great Yarmouth Air Station . . . . .	27
II. The Naval Manœuvres of 1913 and the Part played by Great Yarmouth Air Station . . . . .	46
III. The Growth of Great Yarmouth Air Station . . . . .	58
IV. The Events at Great Yarmouth Air Station from January to August 1914 . . . . .	66
V. The State of Development in the Royal Naval Air Service at the Outbreak of the War . . . . .	81
VI. The Development of the Imperial German Naval Air Service up to the Outbreak of the War . . . . .	89
VII. The First Months of the War at Great Yarmouth Air Station . . . . .	99
VIII. The Activities during 1914 of the German Air Stations opposed to Great Yarmouth Air Station . . . . .	112
IX. The Activities of Great Yarmouth Air Station during the year 1915 . . . . .	117
X. The General Development of the Royal Naval Air Service during the year 1915 . . . . .	145
XI. The Activities during 1915 of the German Air Stations opposed to Great Yarmouth Air Station . . . . .	155
XII. The Activities of Great Yarmouth Air Station during the year 1916 . . . . .	161
XIII. The 'Air Agitation' and the General Development of the Royal Naval Air Service during the year 1916 . . . . .	204
XIV. The Activities during 1916 of the German Air Stations opposed to Great Yarmouth Air Station . . . . .	227
XV. The Activities of Great Yarmouth Air Station during the year 1917 . . . . .	236

XVI. The Coming of the Royal Air Force and the Technical Development of the Royal Naval Air Service during the year 1917 . . . . .	284
XVII. The Activities during 1917 of the German Air Stations opposed to Great Yarmouth Air Station . . . . .	297
XVIII. The German Submarine Campaign against Mercantile Shipping . . . . .	305
XIX. The Development of the Zeppelin Airship and the Imperial German Airship Service during the War . . . . .	316
XX. The Events at Great Yarmouth Air Station during 1918 up to the Formation of the Royal Air Force . . . . .	347
XXI. The Royal Air Force . . . . .	373
XXII. The Events at Great Yarmouth Air Station from the Formation of the Royal Air Force until the Armistice . . . . .	377
INDEX . . . . .	431

## LIST OF PLATES

The Royal Air Force Station, Great Yarmouth, in the Summer of 1918	<i>frontispiece</i>
The first machine to arrive at Great Yarmouth air station, No. 69 Maurice Farman 'Longhorn' . . . . .	facing page 66
No. 20 Short seaplane equipped with the G.R.W. gear . . . . .	" 66
Commander C. R. Samson, R.N., flying in a Short seaplane over H.M.S. <i>Lion</i> during the Naval Review, July 1914 . . . . .	facing page 78
<i>L. 3</i> . . . . .	" 92
Borkum seaplane station . . . . .	" 156
Norderney seaplane station . . . . .	" 156
German official Patrol Chart . . . . .	" 160
'Eighty-six-sixty-six' . . . . .	" 236
Messages passed by Chief Petty Officer V. F. Whatling to Flight Lieutenant C. J. Galpin before and after the action with <i>L. 22</i> , May 14, 1917 . . . . .	facing page 238
<i>L. 44</i> . . . . .	" 260
The pigeon message of September 5, 1917, sent by Squadron Commander Vincent Nicholl from H. 12, 8666 . . . . .	facing page 264
Flight Lieutenant G. H. Trewin, Squadron Commander Vincent Nicholl, D.S.C., Flight Lieutenant R. Leckie, D.S.C., and Flight Lieutenant A. H. H. Gilligan aboard H.M.S. <i>Halcyon</i> after their rescue . . . . .	facing page 264
Zeebrugge seaplane station . . . . .	" 300
German seaplanes capturing a Dutch sailing barge, May 17, 1918 . . . . .	" 300
The coastal airship <i>C. 27</i> falling in flames December 12, 1917. Photographed from one of the attacking German machines . . . . .	facing page 302
One of the results of 'unrestricted' submarine warfare . . . . .	" 308
Fregattenkapitän Peter Strasser . . . . .	" 316
<i>L. 12</i> . . . . .	" 317
<i>L. 30</i> . . . . .	" 320
<i>L. 57</i> . . . . .	" 320
<i>L. 71</i> . . . . .	" 322
One of the engine cars of <i>L. 70</i> . . . . .	" 346
F. 2a flying-boat over the North Sea . . . . .	" 368
Convoy photographed from escorting Short seaplane . . . . .	" 368
Oberleutnant Christiansen . . . . .	" 382
Destroyer towing a lighter and Sopwith Camel . . . . .	" 392
Captain E. A. Mossop's flying-boat burning on the water. Photograph taken from one of the German machines . . . . .	facing page 404

L. 70. Shot down in flames August 5, 1918, by Major Egbert Cadbury, D.S.C., D.F.C., and Captain Robert Leckie, D.S.O., D.S.C., D.F.C.	facing page 407
Major Egbert Cadbury, D.S.C., D.F.C., and Captain Robert Leckie, D.S.O., D.S.C., D.F.C., photographed at Great Yarmouth air station a few hours after they had shot down L. 70 . . . . .	facing page 414
L. 53. Shot down in flames by Captain S. D. Culley, D.S.O., August 11, 1918	facing page 418
Sopwith Camel slung under H.M.A. R. 33 . . . . .	" 420
Flying-boats aboard towing-lighters . . . . .	" 424
Chart to illustrate operations in the southern portion of the North Sea	<i>at end of volume</i>

## LIST OF TEXT ILLUSTRATIONS

Short S. 38, 50 H.P. Gnôme . . . . .	page 8
Maurice Farman 'Longhorn', 70 H.P. Renault . . . . .	" 37
Short Seaplane, 100 H.P. Gnôme . . . . .	" 41
Borel Monoplane, 80 H.P. Gnôme . . . . .	" 43
Maurice Farman 'Shorthorn', 70 H.P. Renault . . . . .	" 49
Caudron Amphibian, 100 H.P. Gnôme . . . . .	" 51
Henri Farman, 80 H.P. Gnôme . . . . .	" 67
Short Gun-carrier, 160 H.P. Gnôme . . . . .	" 80
Sopwith Seaplane, 100 H.P. Anzani . . . . .	" 111
Sopwith 'Schneider', 100 H.P. Gnôme . . . . .	" 147
Sopwith Seaplane, 100 H.P. Gnôme . . . . .	" 149
B.E. 2c, 90 H.P. Raf . . . . .	" 151
Bristol 'Bullet', 130 H.P. Clerget . . . . .	" 153
Friedrichshafen Seaplane . . . . .	" 160
Sopwith 1½-Strutter, 130 H.P. Clerget . . . . .	" 211
Sopwith 'Pup', 80 H.P. Le Rhône . . . . .	" 213
Short Seaplane, 320 H.P. Sunbeam . . . . .	" 215
H. 12, 2 Rolls-Royce 'Eagle' . . . . .	" 217
'Horace' Farman . . . . .	" 257
D.H. 4, Rolls-Royce 'Eagle' . . . . .	" 291
Sopwith 'Camel', 130 H.P. Clerget . . . . .	" 291
Fairey IIIC, Rolls-Royce 'Eagle' . . . . .	" 291
F. 2a, 2 Rolls-Royce 'Eagle' . . . . .	" 293
Brandenburg Sea-monoplane . . . . .	" 303
Sopwith 'Schneider', 130 H.P. Clerget . . . . .	" 369
D.H. 9, 240 H.P. Siddeley 'Puma' . . . . .	" 380
D.H. 9a, 400 H.P. Liberty . . . . .	" 381

## BIBLIOGRAPHY

THE following authorities have been consulted by the author in the preparation of this history:

*The War in the Air*, volume i. Sir Walter Raleigh.

*The War in the Air*, volume ii. H. A. Jones.

*Naval Operations*, volumes i-iii. Sir Julian Corbett.

*The Grand Fleet, 1914-1916. Its Creation, Development, and Work*. Admiral Viscount Jellicoe of Scapa.

*The Crisis of the War*. Admiral Viscount Jellicoe of Scapa.

*The Naval History of the World War*, volumes i-iii. (Compiled from data provided by the Historical Section, U.S.N.) Captain Thomas G. Frothingham.

*The World Crisis* (4 volumes). The Right Honourable Winston S. Churchill.

*Battleships in Action*, volume ii. H. W. Wilson.

*The Dover Patrol, 1915-1917*. Rear-Admiral Sir Reginald Bacon.

*The Story of our Submarines*. 'Klaxon.'

*Memories*. Lord Fisher.

*Records*. Lord Fisher.

*The Old Flying Days*. Major C. C. Turner.

*The Spider Web*. 'Pix.'

*In the Royal Naval Air Service*. Harold Rosher.

*The History of the Eastchurch Air Station Sheppey, 1909-1926*.

*British Airships, Past, Present, and Future*. Major George Whale.

*The German Air Raids on Great Britain, 1914-1918*. Captain Joseph Morris.

*The Defence of London, 1915-1918*. Commander A. Rawlinson, R.N.V.R.

*The Great Munition Feat, 1914-1918*. George A. B. Dewar.

*R.F.C. H.Q., 1914-1918*. Maurice Baring.

*The Beginnings of Organized Air Power*. J. M. Spaight.

*Fighting Ships*. F. T. Jane.

*All the World's Aircraft*. C. G. Grey.

The War Cabinet-Report for the Year 1917 (Cd. 9005).

The War Cabinet-Report for the Year 1918 (Cd. 325).

Synopsis of the British Air Effort during the War (Cd. 100).

Memorandum on Naval and Military Aviation (Cd. 6695).

Reports of the Advisory Committee for Aeronautics.

Files of *The Times*, *The Aeroplane*, and *Flight*.

*Germany's High Sea Fleet in the World War*. Admiral R. Scheer.

*The Zeppelins*. Captain Ernst A. Lehmann and Howard Mings.

*Der Krieg zur See*. Fregattenkapitän D. Gross.

*Taschenbuch der Luftflossen.* Dr. Ing. Werner von Langsdorff.

*Die deutschen Luftstreitkräfte im Weltkriege.* (The German and English editions.)  
Major G. P. Neumann.

*Fünfundzwanzig Jahre Zeppelin-Luftschiffbau.* Dr. Ing. E. H. L. Dürr.

*Der Luftschiffbau Schütte-Lanz 1909-1915.* Dr. J. Schütte.

*Luftschiff und Luftschiffahrt in Vergangenheit, Gegenwart und Zukunft.* Marine-Baurat Engberding.

*Deutschlands Krieg in der Luft.* General von Hoeppner.

*In der Luft unbesiegt.* Major G. P. Neumann.

*Zwei deutsche Luftschiffhäfen des Weltkrieges, Ahlhorn und Wildeshausen.* Dr. Fritz Strahlmann.

*Les Hydro-aéroplanes.* Pierre Rivière.

## INTRODUCTION

### THE EARLY DAYS OF AVIATION IN THE ROYAL NAVY

THE 'Articles of War' state that on the Royal Navy 'under the good Providence of God, the wealth, safety, and strength of the Kingdom chiefly depend', thus defining the responsibility of the Senior Service. It is, therefore, natural for those on whom devolves the duty of maintaining the Navy as 'a safeguard unto our most gracious Sovereign Lord . . . and his Dominions, and a security for such as pass upon the seas upon their lawful occasions' to observe a cautious attitude towards any untried courses and new devices.

Despite the urgings of enthusiasts, the policy of the Admiralty towards the employment of aircraft in the Navy up to the end of 1911 was one of 'keeping in touch' with the development of aerial flight rather than hastening its adoption. While many naval officers were alive to and very keenly interested in the possibilities of aircraft for fleet purposes, they were equally, as practical seamen, only too well aware of the high standard that aircraft must attain if it were to be of real use in the Navy, and until that standard had been reached its employment must be only experimental. Kipling wrote that 'The Navy is very old and very wise', and it showed some of this wisdom in its attitude towards the adoption of aircraft for its own particular purposes.

It cannot be said that the Navy welcomed aviation—it did not—Englishmen as a rule do not welcome innovation—but it made plain the conditions that must be satisfied by aircraft if such were to be employed for naval purposes. It gave help and—in the majority of instances—fair play and, may it be said, at times showed considerable patience and indulgence.

In March 1907 the two brothers Wright offered to sell their patents to the Admiralty, but this offer was refused because it was felt at the time that the employment of aeroplanes in the Naval Service would not be of any practical use. Although this decision was regarded with chagrin by enthusiasts, yet it was the outcome of policy, for it was felt inadvisable at that stage to spend public money on devices which seemed then to be of problematical value. It should be remembered that at that period the English Channel had not been flown (not until

July 25, 1909), and the majority of people were sceptical as to the possibilities of mechanical flight.

The earliest experiments in aeronautics undertaken by the Admiralty were made with craft lighter than air, for it was the opinion of those with a knowledge of the subject that, for naval purposes, the airship had some advantages over the aeroplane. The advantages were that it could carry a larger crew, had a greater endurance, and was capable of taking up a stationary position, none of which did the aeroplane then possess. Again, it could carry wireless telegraphic apparatus—a necessity for naval reconnaissance work—and in the case of engine failure when over the sea there was not the almost certain loss that there would be under the same conditions with an aeroplane.

At that time (1908) considerable interest was being shown throughout the civilized world in the performance of the Zeppelin airship. Although overstatement was common with respect to the possibilities both in Germany and in this country, there is no doubt that in the Admiralty it was felt that the airship was a device of promise and one which should receive serious attention. The first outward move was made when on July 21, 1908, Captain R. H. S. Bacon, D.S.O., R.N., then Director of Naval Ordnance, submitted certain proposals to the First Sea Lord, Admiral Sir John Fisher. They were, firstly, that a Naval Air Assistant be appointed; secondly, that the War Office be approached and requested to place the Superintendent of Ballooning in close touch with the Admiralty; and thirdly, that a rigid type of airship be laid down for the Navy, and that the firm of Vickers Sons & Maxim, Ltd., be consulted with respect to the design of such an airship.

These suggestions received the support of Admiral Sir John Fisher and the Board of Admiralty and in due course were submitted to the Committee of Imperial Defence, which, under the Chairmanship of Viscount Esher, had been engaged for some time in considering the question of the aerial defence of the country. It reported (January 28, 1909) that while at that time it did not feel that the country was exposed to any great danger of aerial attack, nevertheless, it thought it would be imprudent and dangerous to neglect taking precautions. It believed that the possibilities of airships and aeroplanes, and the dangers to which we might be exposed by their use, could only be ascertained by building and employing them ourselves. In pursuance of this policy, the Committee recommended that the sum of £35,000

should be included in the Naval Estimates of 1909-10 for the purpose of building an airship of a rigid type, this sum to include the cost of all preliminary and incidental expenses, and further, that in addition to this amount the sum of £10,000 should be included in the Army Estimates for the same period, for making experiments with navigable balloons of a non-rigid type, and for the purchase of complete non-rigid airships and their component parts. Meanwhile (August 14, 1908), Vickers Sons & Maxim, Ltd., had been asked to submit a price for the building of a rigid type of airship. The firm submitted its tender and on May 7, 1909, this was accepted.

As soon as the order was placed a special branch was formed at the Admiralty to handle all questions relating to her construction. The personnel consisted of Captain Murray Sueter, R.N., who was given the title of 'Inspecting Captain of Aircraft', and with him were Lieutenant Neville F. Usborne, R.N., and Chief Artificer-Engineer Sharpe, R.N., who, borne on the books of H.M.S. *Hermione*, watched the construction of the airship at the makers' works at Barrow-in-Furness. Captain Oliver Schwann, R.N., was appointed Assistant-Inspecting Captain of Aircraft, and Lieutenant C. P. Talbot was appointed afterwards as an additional assistant. During the course of the year the construction of No. 1, *Rigid Naval Airship*, or, to give her other and popular name, *The Mayfly*, proceeded, but the public was fed on a 'diet of conjecture' with regard to her.

Soon after this special branch was formed the authorities began to lay the foundations of the future Naval Air Service. In April 1909 the Government appointed 'The Advisory Committee for Aeronautics' under the presidency of the Right Honourable Lord Rayleigh, O.M., F.R.S. The Committee had ten members. The Chairman was Dr. R. T. Glazebrook, F.R.S., the Director of the National Physical Laboratory. The Royal Navy was represented by Captain R. H. S. Bacon, D.S.O., the Army by the Master-General of Ordnance, Major-General Sir Charles Hadden, K.C.B., and the Meteorological Office by Dr. W. N. Shaw, F.R.S. The other members were Mr. Horace Darwin, F.R.S., Sir A. G. Greenhill, Mr. F. W. Lanchester, Mr. H. R. A. Mallock, F.R.S., and Professor J. E. Petavel. To these, shortly after, were added Mr. Mervyn O'Gorman, when he took over the charge of the balloon factory, and Captain Murray Sueter, R.N. The value of this Committee was that it brought together the various bodies concerned with aeronautics and combined their

efforts. In particular, it gave to the new science the skilled services of the National Physical Laboratory, which organized a new department for the investigation of aeronautical problems.

In April of the next year (1910) the Admiralty decided that a commission should be sent over to France, firstly with the object of investigating the progress of aviation in that country, and secondly to attend the first International Conference on Aerial Navigation which was to be held in the French Foreign Office in the following month. This Conference duly met in Paris on May 18, 1910, when the principal items on the agenda for discussion were such matters as the rules of the air, the distinguishing marks of aircraft, and the certification of pilots, for example—subjects of great importance which were urgently in need of settlement. A decision on these points was never fully reached because of the behaviour of the German delegate, one Herr Kreige, who desired the adoption of a declaration that the navigation of the air above all foreign countries should, in principle, be free. Owing to the momentous character of this proposal the matter was referred to the responsible department for an opinion, which in due course gave utterance to the famous dictum: 'No regulations should be framed which in any way exclude or limit the right of any state to proscribe the conditions in which the air above its territory should be navigated.' One wonders whether or not the framers of this declaration ever thought of how soon it was to be contested by force of arms. During the discussion of the declaration the tone of the Conference was changed and became so heated that eventually it was adjourned until November 28 (1910), and then *sine die* without further meeting. Although it had proved abortive in that it had not settled the main questions for which it had been convened, those in authority felt strongly that the matter should not be allowed to rest. Consequently a Bill was drawn up, entitled 'Aerial Navigation Bill 1910', the preamble to which contained an assertion of the principles that the air above all parts of His Majesty's Dominions and the territorial waters adjacent thereto were inviolable. It was felt at the time that by giving such a lead other nations might be induced to follow suit. The proposals contained in the Bill never became law, owing to a crowded session, but in 1911 a shorter Bill was introduced which led to the 'Aerial Navigation Act 1911', which conferred on the authorities powers for the suppression of dangerous flying, and also named certain areas over which flying by foreign or civilian pilots was

prohibited. It was forbidden to fly over some defended ports, wireless stations, and certain State and private armament factories. This Act received the Royal Sanction on February 14, 1913.

Early in 1910 it was decided, in view of the effect on the Navy which the destruction of naval magazines, explosive factories, dockyards, and similar places would have, that the possibility of attack by hostile aircraft should be considered seriously, with a view to precautions being taken to meet the danger. It was felt also that early action was important because special guns, projectiles, fuses, for example, would have to be designed for the purpose. Incidentally, it appeared that certain experiments made abroad seemed to demonstrate that an airship afloat could only be brought rapidly to the ground by the burning of the gas within the envelope.

There appeared to be two forms of protection against airship attack—mobile and fixed. In the first category were placed airships and aeroplanes and guns mounted on motor-cars. The fixed defences might be, firstly, earth or armour protection above the magazine or explosive factory, and secondly, high-angle-fire guns capable of being laid in all directions from the position of the vulnerable points. It was thought, however, that the best method of meeting airship attacks was by means of airships, but not exclusively, and meanwhile steps should be taken to protect all vulnerable points by the establishment of either fixed or mobile anti-aircraft guns stationed in the vicinity, premising that it might eventually be considered necessary to have a combination of the two types. It was decided that, in order that any defending airships provided should be free to assume an active role, fixed defences in certain cases should be established. The basic principles of anti-aircraft defence as now known were thus outlined, and it was suggested that experiments should be made as soon as possible with a view to acquiring more information regarding the conditions affecting aerial attack in order to determine the best type of ordnance for defence. It was recommended that new magazines and buildings for storing explosive material should, wherever possible, be built underground and so constructed as to be inconspicuous and, for this reason, difficult to identify from the air.

It is interesting to note that these decisions went farther than those of Viscount Esher's sub-committee eighteen months earlier, for it was considered now that, with wind and weather favourable, attacks by airships against our magazines and stores might be

regarded as amongst the possible operations of war. These facts are given for the purpose of showing that continuity of purpose which was demonstrated at each stage of the preliminary proceedings and the subsequent organization of the aerial arm, and in the light of latter-day knowledge it will be seen how prescient were these views.

In 1910 the Admiralty went so far as to consider the advisability of erecting airship sheds along the east coast of the United Kingdom, but the scheme did not mature till some three years later.

Although the Admiralty had from the first inclined to the use of the airship rather than to the aeroplane, it must not be thought that, despite its refusal (in 1907) to purchase the patents of the brothers Wright, it was uninterested in the development of craft heavier than air. Since that date (1907) rapid progress had been made with aeroplanes throughout the world, so much so that when in February 1911 the Royal Aero Club informed the Admiralty that one of its members, Mr. Francis McClean, was prepared to lend two of his aeroplanes, free of charge, for the purpose of enabling naval officers to learn how to fly, the offer was accepted. Mr. McClean had devoted a large part of his fortune to the cause of aviation, and in the year 1909 had given to the Aero Club an aerodrome at Eastchurch in the Isle of Sheppey, for the free use of its members, in return for the fixed rent of one shilling a year payable by the club. Another member of the club, Mr. C. B. Cockburn, acted eventually as honorary flying instructor to the selected officers. Mr. Cecil Grace was selected originally for the post, but he was lost on December 22, 1910, when flying over the English Channel. Mr. Cockburn was one of the pioneers in aeronautics, and had represented this country at that historic aviation meeting—the first in the world—held at Reims during the last week in August 1909. The nation owes much in the early years of the Naval Air Service to the work of these gentlemen.

The Admiralty called for volunteers, and out of the two hundred or so who came forward selected four officers, by name, Lieutenants C. R. Samson (H.M.S. *Foresight*), R. Gregory (H.M.S. *Antrim*), A. M. Longmore (H.M.T.B. 24), and G. Wildman Lushington, R.M.A. (H.M.S. *Bulwark*). The last-named officer had the misfortune to fall sick and his place was taken by another officer of the Corps of Royal Marines, Lieutenant E. L. Gerrard, R.M.L.I. (H.M.S. *Hermione*), although soon afterwards the

former, on his recovery, joined his four brother officers. The four officers reported for duty at Eastchurch on March 2, 1911, and for the purpose of the course were borne on the books of H.M.S. *Wildfire*.

The Royal Aero Club had offered 'free of charge the use at all times of two aeroplanes, of the Flying Grounds at Eastchurch, and of shed accommodation', while the Admiralty was responsible for the fee of £20 to Short Brothers for six months' technical instruction by Mr. Horace Short for each officer, in addition to paying the running expenses at Eastchurch, as well as making good any damage that might be done to the machines. The officers selected must be unmarried, and must become 'members of the Royal Aero Club at their own expense'. The whole arrangement was to hold good for six months and was to be reviewed at the end of that period.

It is not without interest to learn that Short Brothers, in one of their letters to the Admiralty on the arrangements, stated that:

'We propose that they <sup>1</sup> should run round the ground without attempting to rise for one or two practices and then do a few straight line flights. They could then practise turning in a radius of about 440 yards. No practice will take place for the first week or two in winds of over 4 m.p.h. velocity.'

The Admiralty said that there was to be no flying done by the officers on Sundays.

So keen were these officers and so great the skill of Mr. Cockburn that they qualified for the Aviator's Certificate of the Royal Aero Club after less than six weeks of instruction, with only two minor 'crashes', and it is useful to remember that 'instruction in those days was no easy matter; the machines were pushers; the pilot sat huddled up behind the instructor, catching hold of the control by stretching his arm over the instructor's shoulder, and getting occasional jabs in the forearm from the instructor's elbows as a hint to let go'.<sup>2</sup> The first two officers to qualify were Lieutenants Samson and Longmore, R.N., on April 25, 1911, the numbers of their Royal Aero Club Aviator's Certificates being 71 and 72 respectively. The course included technical instruction at the factory of Short Brothers and at some of the principal aircraft works in France. They attended also the French Military Trials held at Reims (in 1911), finally completing their course in September (1911). The two machines on which they had learnt to fly were purchased eventually by the Admiralty.

<sup>1</sup> The selected officers.

<sup>2</sup> *War in the Air*, vol. i, p. 126.

The original agreement between the Royal Aero Club and the Admiralty was that two machines should be lent with which the naval pilots should be taught to fly. One of these two machines, however, was lost together with her pilot (Mr. Cecil Grace) in the English Channel on December 22, 1910. So another was built in its place, and an old one, known as 'The Dud', was added. These three machines of Farman type were built by Short Brothers, and were No. 26 ('The Dud'), which was equipped with a 50 b.h.p. Gnome rotary engine, No. 28, first fitted with a 60 b.h.p. Green and later with a 50 b.h.p. Gnome engine, and No. 34, equipped with a 50 b.h.p. Gnome engine. In addition to his



original loan Mr. McClean provided four of his own machines for the use of naval pilots, and these were flown regularly by them during the years 1911 and 1912. The machines were a monoplane (No. 9) built at Brooklands by The Universal Aviation Company, Ltd. (then irreverently known as *The Universal Destruction Company, Ltd.*), and referred to as 'The Birdling'; she was equipped with a 50 b.h.p. Gnome engine, and in appearance was somewhat similar to a Blériot monoplane, except for alterations in the undercarriage and the 'overhung' system of mounting the engine; a Short biplane, No. 39, which was the first twin-engined machine that ever flew and was familiarly known as 'The Triple Twin'. Later she was purchased by the Admiralty. She had two 50 b.h.p. Gnome engines, one behind the other. The first one drove through chains a pair of tractor airscrews, and the rear one was coupled direct to a propeller; another Short biplane, No. 27, which was somewhat similar to No. 39, known as 'The Vacuum Cleaner' because the draught was

said 'to pull the hairs out of a fur coat'; and Short *No. 36*, which was equipped with a 70 b.h.p. Gnome engine. This last machine was not purchased by the Admiralty, but was returned to Mr. McClean. There were also two other machines in use in 1911—a biplane and a monoplane. The biplane, known officially as 'The Triple Tractor' and popularly as 'The Field Kitchen', was built by Short Brothers, and was a twin Gnome engined tractor machine with three airscrews in front. The central airscrew was driven direct by the front 50 b.h.p. Gnome engine, and each of the wing tractors by chains from the rear engine, both engines being in front of the fuselage and 'in tandem'. The pilot and passenger sat side by side. The monoplane was a single seater, also built by Short Brothers, the two 70 b.h.p. Gnome engines being arranged 'tandem fashion' fore and aft of the pilot and driving, respectively, an airscrew and a propeller. The triangular tail terminated in elevators and rudders as in the Farman biplane. This machine was nicknamed 'The Double Dirty', a soubriquet apparently deserved. Besides these machines there was a little monoplane built by Short Brothers, with a 50 b.h.p. Gnome engine, similar in general lines to the Blériot and other contemporary monoplanes.

During the period the preceding recital covers, progress with the building of the *No. 1, Rigid Airship* (or *The Mayfly*) at Barrow-in-Furness was maintained. Associated with the work of superintendence as an Admiralty representative was Commander Oliver Schwann, R.N., who became fired with an ambition of flying off the water in an aeroplane—the term 'seaplane' had not yet been coined—and for this purpose he bought an Avro machine, equipped with a 45 b.h.p. Green engine, and conducted experiments in fitting various types of floats to her, in place of the wheeled undercarriage, during the ensuing months of 1911. No financial support could be obtained from the Admiralty for these experiments, and Commander Schwann was aided in his efforts by money raised for the purpose by his brother officers and their wives.

In May of this year (1911) Vickers Sons & Maxim, Ltd., delivered *The Mayfly*, and for the next four months basin trials were made with the airship. Some account of the leading features of her construction may not be without interest, observing that the principal idea in the minds of her designers was that she should be capable of being employed in the work of aerial scouting. With this object, the Admiralty had specified that she was

to be able to maintain a speed of 40 knots for 24 hours, to reach an altitude of 1,500 feet, to carry powerful apparatus for wireless telegraphy, and to house her crew in a reasonable state of comfort. Further, when not in the air, but floating on the water, it should be possible to moor her by the bow. These onerous conditions rendered it necessary that the airship should be of larger size than any craft of the kind hitherto built. Her principal dimensions were: length, 512 feet; diameter, 48 feet; net capacity, 640,000 cubic feet, with a total lift of 20 tons, the 'useful' lift being 3 tons. There were 17 gas-bags, with Parseval type automatic gas-valves. Her two stream-lined gondolas, built of Honduras mahogany, were designed to be capable of sustaining severe impact loads when alighting on water. The hull form departed from the current Zeppelin practice, its design being based on the researches of an American, Professor Zahm, and it is stated that the hull resistance was appreciably lower than that of the contemporary Zeppelin airships. This hull was twelve-sided, the framework being built of the alloy duralumin, which at the time was a new material. The envelope was 'doped' with aluminium paint on its top side and with yellow pigment on the lower portions. The motive power was derived from two 180 b.h.p. Wolseley engines which, incidentally, were fitted with an apparatus to recover the water from the exhaust gases.

The airship after her delivery remained moored to a pontoon on the Cavendish Dock, Barrow-in-Furness, for three days (May 22-5, 1911), and successfully rode out gusts of wind of over 40 miles an hour. Her crew remained aboard during the whole of the period stated, their only complaint of the conditions being that they were not allowed to smoke. After her basin trials she was warped into her shed for some alterations because she was found to be deficient in 'useful' lift. Unfortunately she never ascended, for on being transferred from her shed to the mooring buoy on September 24 (1911) she broke her back and was reduced to a total wreck. The subsequent Court of Inquiry (under the presidency of the First Sea Lord) found that the accident was due to structural weakness and exonerated the whole airship party from blame. Moreover, it commended Lieutenant Talbot for his gallantry in rescuing some of the crew from the aft gondola, and Lieutenant Usborne for the presence of mind he showed by deflating certain of the gas-bags—an act which reduced the magnitude of the disaster.

This catastrophe had a far-reaching effect, for it confirmed the

opponents of the airship in their opposition, with the result that it was decided to abandon experiments with rigid airships for the Navy. Not without a struggle did the enthusiasts surrender, and Captain Sueter, fully alive to the danger that threatened the embryo Naval Air Service, begged that the decision should not be carried into effect, but his efforts failed to secure a reversal. There was, however, one source of encouragement, and that lay in the fact that while the Admiralty was not in favour of further experiments with rigid airships it did, nevertheless, recommend that experiments be continued with the development of aeroplanes and hydro-aeroplanes.

During this anxious period the officers at Eastchurch had been carrying on quietly with the material that was available, doing useful work. Incidentally, the pilots had received a much needed addition to the supply of machines used for training and experiment, through the munificence of Mr. H. Barber, who in June (1911) presented two Valkyrie monoplanes, equipped with Green engines, to the Admiralty and, in addition, two to the Army. These monoplanes were of the 'Canard' (or 'tail first') type and, as they were somewhat difficult to fly, they were rarely used. Later, in October of that year (1911), Lieutenant Samson succeeded in persuading the Admiralty to purchase from Mr. McClean two of the training machines which had been lent by the latter and to detail 12 naval ratings for duty at Eastchurch. For administrative purposes the officers and men were borne on the books of H.M.S. *Actaeon*. In this way, by a process of nucleation, was formed the Eastchurch air station—the first naval flying station in this country. The Admiralty entered also into an agreement with Mr. McClean and Short Brothers to rent from them ten acres of ground near the Royal Aero Club aerodrome, with the proviso that the ground might be purchased if the Admiralty eventually desired to do so.

In November (1911) the efforts of Commander Schwann (who, it may be remembered, had been experimenting for months with an Avro biplane fitted with floats at Barrow-in-Furness) were crowned with success, for on the 18th of that month he succeeded in 'taking-off' in her and flying for a short distance, but, unfortunately, he crashed on alighting. Nevertheless, to him falls the distinction of being the first English naval officer to fly off salt water. There was nothing inherently wrong with the machine, for after it had been repaired Mr. S. V. Sippe successfully flew off and alighted on water with her on March 2 of the next year.

(1912). Her pilot on this occasion was an engineer who had previously built a machine to his own design, had taken his Aviator's Certificate in January 1912, and who subsequently played a prominent part in the development of English aviation.

November 18 (1911) was of historical importance (in addition to the achievement of Commander Schwann), for on that day the Prime Minister (the Right Honourable H. H. Asquith) requested the standing sub-committee of the Committee of Imperial Defence, under the Chairmanship of Viscount Haldane of Cloan, 'to consider the future development of aerial navigation for both Naval and Military purposes, the means which might be taken to secure to this country an efficient Air Service, and also, whether steps should be taken to form a corps of aviators for Naval and Military purposes, or otherwise to co-ordinate the study of aviation in the Navy and Army'.

The Committee of Imperial Defence was at that time engaged in the task of co-ordinating the duties of the various Services for use in the event of a European war. The Committee delegated its new task to a technical sub-committee, presided over by Colonel the Right Honourable J. E. B. Seely, M.P. The other members of this sub-committee were Brigadier-General G. K. Scott-Moncrieff, Brigadier-General David Henderson, Lieutenant C. R. Samson, R.N., Lieutenant R. Gregory, R.N. (the fourth officer of the Royal Navy to gain the Royal Aero Club Certificate, May 2, 1911), and Mr. Mervyn O'Gorman, with Rear-Admiral Sir C. L. Ottley and Captain M. P. A. Hankey, R.M.A., as secretaries. The findings of this sub-committee (which were ready by February 27, 1912) were embodied in a report to the Committee of Imperial Defence, which caused that body to make certain recommendations to the Cabinet, and it was the application of some of the recommendations contained in this report which led to the creation of 'The Royal Flying Corps', with its Naval and Military Wings.

It should be mentioned that about this period English people were becoming seriously alarmed at our lack of aircraft, as compared with those possessed by Germany, and the recent incident of the German gunboat, the *Panther*, at Agadir had seriously disquieted them. At the time of the report to which reference has been made we had two small airships and less than 12 aeroplanes for both naval and military requirements, and Germany had about 20 airships and 20 or 30 military aeroplanes.

During December (1911) Mr. Oswald Short and Lieutenant

A. M. Longmore were making experiments with various types of floats and flotation bags for aeroplanes, the object being to guard against total loss in the event of a forced descent on the sea, and the results proved of value for naval purposes. Contemporaneously, the question was raised as to the advisability and practicability or otherwise of being able to fly a machine from the deck of a warship with corresponding return, or whether it might not be the better plan to fly from the deck and, on returning, to alight on the water near the ship. As a contribution towards the solution of this problem, Lieutenant Samson, in December (1911), succeeded in flying a 'pusher' Short biplane (S. 38) off a special deck which had been built over the bows of H.M.S. *Africa*, which ship was at the time lying at anchor in Sheerness Harbour. The machine was fitted with a form of amphibian undercarriage, in that it had wheels on each side of the floats, and also one float under the tail. Lieutenant Samson flew from the deck and alighted on the sea without damage to his machine, but was unable to fly off again as the floats were not stepped wooden floats but merely tubular bags lashed alongside the wheel skids.

The same month the functions of the naval side of aviation were outlined, and amongst the duties of naval aviators it was stated that in time of war they would be required:

- (a) To ascertain which vessels were in enemy harbours and which could not be seen from blockading ships.
- (b) To ascend from a floating base and ascertain if any of the enemy's vessels be in sight. (This remark is of interest, as it contains the germ of the future aircraft-carrier.)
- (c) To locate submarines.
- (d) To detect minefields. (Experiments had been conducted some months previously in this connexion from Eastchurch over the Thames Estuary, but owing to the large amount of mud in suspension in the water they had not met with much success.)
- (e) To direct the fire of ships' guns.

Attention was soon to be drawn to this list of the various duties expected from the naval aviator, owing to the submission by Lieutenant H. A. Williamson, R.N. (a submarine officer holding the Royal Aero Club Certificate), of a paper, on January 2 of the following year (1912), dealing with the use of aeroplanes in detecting submarines, and an elaboration of the idea of an

aircraft-carrier. This paper is of considerable historical value, and a testimony to the author's foresight and imagination, for the ideas he expressed are substantially those which were successfully developed during the War of 1914-18. Lieutenant Williamson drew attention to the value of aircraft (operating from a parent ship) for anti-submarine duties, and described how depth-charges (he said 'bombs exploding 20 feet under the surface of the water') might possibly be used to destroy submarines. In addition a scheme was elaborated for fitting ships with a device to enable machines to 'take-off' and land again on return along certain wires. The whole scheme, however, was pronounced by the Admiralty to be impracticable; nevertheless, Lieutenant Williamson did some good, in that his paper aroused interest, and in June and September (1912) attempts were made at Harwich and Rosyth to detect submarines from the air. The shallow tidal waters were found to be very opaque, but in clear weather a periscope could be seen from a considerable distance, and in misty weather the machine, when it sighted a submarine on the surface, could dive over the latter before she could submerge. Curiously, the idea of landing along wires had been tried in the United States of America, for Lieutenant T. G. Ellyson, U.S.N., in September 1911 had succeeded in launching a Curtiss machine from a wire cable, but from the beach and not from a ship.<sup>1</sup>

Other experimental work of interest conducted at Eastchurch air station were some attempts in March (1912) to bomb from an aeroplane made by Commander Samson with a 100-lb. dummy bomb. Experiments with new machines were also being made, and in the same month (March) a hydro-aeroplane that proved a success had been produced by Mr. Horace Short and Commander Samson, and in addition Mr. T. O. M. Sopwith succeeded in making the first all-British flying-boat, which was also successful. Contemporary with these efforts were those of the Aircraft Factory, which made some experiments with floats on a land machine (*F.E. 2*) which was flown by Mr. E. W. Copland-Perry, one of the test pilots attached to the factory; this machine did not prove to be satisfactory.

Aviation in the Royal Navy now received a set-back, for on January 3 (1912) the Admiralty decided, owing to the loss of

<sup>1</sup> This officer, after a distinguished career in the United States Navy, was drowned on February 27, 1928, while trying to fly from Norfolk, Va., to Annapolis: for a biography of him vide *The Aeroplane*, March 7, 1928.

*The Mayfly*, to close down airship construction, and the special branch was disbanded on the 25th, and Captain Sueter and his brother officers were ordered to report for general service. Their disappointment must have been considerable, but the cessation of their efforts was destined to be temporary.

On February 27 (1912) the technical sub-committee (under the presidency of Colonel Seely) presented its report to the Committee of Imperial Defence—a task delegated to them, it may be remembered, from the previous November. A month before this report was presented, the Admiralty had recommended independently the establishment of an aeroplane depot near Sheerness, a competition for hydro-aeroplanes, and, in addition, it put forward a comprehensive airship programme. During the two months, however, which elapsed between the presentation of the report of the technical sub-committee (February 27, 1912) and its approval by the Committee of Imperial Defence (April 25, 1912), further information on the subject of airship development in Germany had been brought to the notice of the authorities. This information indicated the change of opinion and the attitude towards airships which had taken place in Germany during the previous four months, caused, in part, by the excellent performances of the *Schwaben* (Zeppelin), Siemens-Schuckert, and the latest Parseval airships, and showed that German opinion, which had veered in favour of aeroplanes owing to the fears induced by early disasters with the country's airships and, in part, to the progress made in France with aeroplanes, was undergoing a change in the direction of the airship.

On April 25 (1912) the Committee of Imperial Defence approved the report that had been prepared by the technical sub-committee, to which reference already has been made. In its scheme for the reorganization of the aeronautical Services it recommended the formation of a single Service, to be known as 'The Flying Corps'. This Corps was to consist of a Naval and a Military Wing. All pilots in future were to be trained at one central flying school, to be maintained at the joint expense of the Admiralty and the War Office, but this school was to be administered by the latter authority. Moreover, there should be formed a reserve of flying officers. The proposed new organization should include the Aircraft Factory at Farnborough. In this report it was stated, amongst other proposals and opinions, that it was desirable that a permanent consultative committee, consisting of 12 members (to be known as 'The Air Committee') should be

appointed to deal with all aeronautical questions affecting both the Admiralty and the War Office,<sup>1</sup> the President to be a Secretary of State. The members suggested were: President, His Majesty's Principal Secretary of State for War; the Commandant of the Central Flying School; the Officer Commanding the Naval Wing; the Officer Commanding the Military Wing; the Director of the Operations Division, War Staff, Admiralty; the Director of the Air Department; the Director of Military Training, War Office; the Director of Artillery, War Office; the Director of Fortifications and Works, War Office; Chairman of War Office Flying Committee; the Superintendent of the Royal Aircraft Factory, and a representative of the Treasury.

In order to facilitate cross-country flying, it was recommended that landing rights should be obtained at or near the following named places: North Berwick, Newcastle, Cleethorpes, Cromer, Harwich, Dover, Portsmouth, Plymouth, and the Lizard. Moreover, the opinion was expressed that, owing to the strategical position of these places, naval and military aerodromes must eventually be established in their vicinity. Thus was foreshadowed that system of coastal air stations destined shortly to be established, and included in this system was one which forms the principal theme of this story, namely, the station at Great Yarmouth. The whole report indicated a wide and extended vision and provided the basis of a scheme for an organization which, although small at the beginning, was nevertheless capable of being greatly expanded—a truth which was demonstrated in the war that was soon to come.

The Committee realized that the aerial needs of the Navy and Army differed, but its intention was that pilots of either branch of the Services, in addition to specializing in their own particular sphere, should be regarded as a reserve for the other Service. Thus, in a purely naval war the whole of the Flying Corps would be available for the Navy, and in a purely land war (if such a war can be conceived where the British Empire is concerned) the whole Corps would be at the disposal of the Army. It should be remembered that at the time the people of this country refused to credit the idea that the Army would ever be engaged in a European war—thinking that, if ever we were embroiled, it would be purely a naval struggle.

Some of the recommendations contained in this report were subsequently presented as a White Paper to both Houses of

<sup>1</sup> *Vide The War in the Air*, vol. i, pp. 211-12.

Parliament by Command of His Majesty the King,<sup>1</sup> and the following clauses extracted from this report, dealing with naval aviation, are of interest:

'The strategical and tactical uses of the aeroplane as an adjunct to the operations of a fleet cannot yet be forecasted with certainty, but it is clear that this country cannot afford to incur the risk of dropping behind other nations in this matter, and that every facility must be given for experiment and progress.

'There are admittedly advantages in a policy of postponing the development of aeroplanes for naval and military purposes, and of leaving the pioneer work to private enterprise and to foreign nations, but it is clear that aeroplanes have now to a great extent passed out of the experimental stage as regards their employment in warfare, and an active and progressive policy has therefore become imperatively urgent. . . .

'It is impossible to overestimate the importance of experiments for the development of hydro-aeroplanes, and in flying from and alighting on board ship, and in the water under varying conditions. Until such experiments have proved conclusively how far such operations are practicable, it is impossible to forecast what the role of aeroplanes will be in naval warfare, or to elaborate any permanent organization. The present organization must therefore be regarded as provisional. . . . The prospects of the successful employment of the rigid type of airship are not sufficiently favourable to justify the great cost, and it is therefore recommended that the naval experiments should be confined to the development of aeroplanes and hydro-aeroplanes. The utmost vigilance will be taken, however, in watching foreign developments, and the present recommendations will not be taken to prejudice a reopening of the same question should important developments occur.'

The report was accepted by the Government of the day, and 'The Royal Flying Corps' was constituted shortly afterwards (April 13, 1912) by Royal Warrant. A special Army Order was issued two days later detailing the necessary regulations, and on May 13 the 'Air Battalion of the Corps of Royal Engineers' (which superseded on February 28, 1911, the Balloon School, which itself started at Woolwich in 1878) and its reserve were absorbed by the new body.

The decision to form the central flying school, following the recommendation of the report, was made soon, and a site was selected at Upavon, in Wiltshire, when the work of erecting the temporary buildings was quickly started. The school, which was named the 'Central Flying School', was opened on June 19, 1912 (although the first course did not start till August 17, 1912),

<sup>1</sup> Memorandum on Naval and Military Aviation, April 11, 1912. Cd. 6067.

with Captain Godfrey Paine, C.B., M.V.O., R.N., as its first Commandant. To Captain F. H. Sykes was given the command of the Military Wing. His Adjutant was a Grenadier Guardsman—Lieutenant B. H. Barrington-Kennett. To the latter the Military Wing of the Corps owed more than to most men. It was he who inculcated in the early days the wonderful discipline and *esprit de corps* for which the Royal Flying Corps became known and admired. It was said by a schoolboy that 'a gentleman is a man who loves God very much and has beautiful manners'. By those who knew him it was felt that these words perfectly described this officer, now unhappily dead. He went back to his regiment in time of dire need, although he was certain of a rapid promotion in the Royal Flying Corps, and was killed in action in May 1915, while serving in France before Festubert.

Space will not permit the inclusion of the syllabus of instruction in the School, which was arranged 'to teach those things which make the difference between the mere airman and the airman in war'.

On the creation of the Naval Wing of the Corps, the Admiralty appointed Captain Sueter as the Director of a special department at the Admiralty—'The Air Department'—to deal with all questions and organization relating to aircraft in commission with the Navy, and Commander Samson (acting) to the command of the Naval Flying School at Eastchurch. Captain Sueter had as his assistants in the new Department (which came into being in November of the same year—1912) Commander Schwann, Lieutenant C. J. L'Estrange Malone, and Engineer-Lieutenant G. W. S. Aldwell, R.N.

For administrative purposes the Naval Flying School at Eastchurch was placed under the orders of the Captain of H.M.S. *Actaeon* of the Nore Command, and all officers and men were to be borne on the books of this ship. As under the new scheme all the preliminary training of pilots was to take place at the Central Flying School, it was decided that the part to be taken in the future by the station at Eastchurch was that of an experimental unit, and, in addition, it was to provide opportunities for the specialized training of officers and ratings. Actually, however, the work of giving a preliminary training never ceased at Eastchurch, and pilots for the Naval Wing and Royal Naval Air Service continued to receive their first instruction at this aerodrome before and throughout the period of the War of 1914-18.

At the time of the formation of the Royal Flying Corps (May 13)

there were 22 officers in the Naval Wing—8 of whom held the Aviator's Certificate of the Royal Aero Club. Their names are given below:

Captain G. M. Paine, C.B., M.V.O., R.N.  
 Captain Murray F. Sueter, R.N.  
 Commander Oliver Schwann, R.N.  
 Commander E. A. D. Masterman, R.N.  
 Lieutenant (acting Commander) C. R. Samson, R.N.  
 Lieutenant N. F. Usborne, R.N.  
 Captain (temporary Major) E. L. Gerrard, R.M.L.I.  
 Lieutenant R. Gregory, R.N.  
 Lieutenant A. M. Longmore, R.N.  
 Captain R. Gordon, R.M.L.I.  
 Lieutenant S. D. A. Grey, R.N.  
 Lieutenant C. J. L'Estrange Malone, R.N.  
 Lieutenant F. L. M. Boothby, R.N.  
 Lieutenant J. W. Seddon, R.N.  
 Lieutenant H. L. Woodcock, R.N.  
 Engineer-Lieutenant E. F. Briggs, R.N.  
 Lieutenant W. Parke, R.N.  
 Staff Surgeon H. V. Wells, R.N.  
 Lieutenant Raymond Fitzmaurice, R.N.  
 Sub-Lieutenant F. E. T. Hewlett, R.N.  
 Assistant Paymaster J. H. Lidderdale, R.N.  
 Engineer-Lieutenant C. J. Randall, R.N.  
 Engine-Room Artificer F. W. Scarff.

The official name 'Royal Flying Corps, Naval Wing,' after making its appearance in a few documents, dropped out of use, and its place was taken by a name which, in process of time, received the stamp of official recognition—'The Royal Naval Air Service'. Thereafter, the words 'Military Wing', though they were still used, were no longer required, and 'The Royal Flying Corps' became a sufficient description of what was a distinctly military body. The Admiralty, from the very first, worked independently,<sup>1</sup> for it felt that the Naval Wing must be a part of the Navy, and its officers should be naval officers who could fly, rather than flying officers with but a rudimentary knowledge of naval matters and customs. In short, pilots of the Naval Wing must regard the air 'as merely the roof of the sea'.

Naval aeroplanes took part in a review of the Fleet at Weymouth, held on May 8 (1912). The No. 2 aeroplane, fitted with

<sup>1</sup> Vide *The War in the Air*, vol. i, p. 207.

flotation bags and a 70 b.h.p. Gnome engine (in place of the 50 b.h.p. engine) was flown successfully by Commander Samson from the forecastle of H.M.S. *Hibernia* while she was steaming at a speed of 10½ knots. A 100 b.h.p. Short hydro-aeroplane and a Nieuport monoplane also made successful flights. Commander Samson, Captain Gerrard, R.M.L.I., and Lieutenants Gregory, Longmore, and L'Estrange Malone took part in this review. Two months later (July) a machine was flown from H.M.S. *London* while she was steaming at a speed of 10 knots.

During June the technical sub-committee of the Committee of Imperial Defence dispatched two of its members, the Director of the Air Department, Admiralty (Captain Sueter), and the Superintendent of the Royal Aircraft Factory (Mr. Mervyn O'Gorman) to France, Austria, and Germany to report primarily on the state of development of airships in these countries. They visited air stations and aircraft factories and made a journey in the Zeppelin airship *Viktoria Luise*. They returned to this country deeply impressed by what they had seen—especially in Germany. Their report was presented to the technical sub-committee in July (1912), and this body, at a later date, drew some further lessons from it.

'The report', they said, 'shows that German airships have, by repeated voyages, proved their ability to reconnoitre the whole of the German coastline on the North Sea. In any future war with Germany, except in foggy or stormy weather, it is probable that no British war vessels or torpedo craft will be able to approach within many miles of the German coast without their presence being discovered and reported to the enemy. Unless we had obtained command of the air, any idea that our torpedo craft could seek shelter among the Frisian Islands and remain there undetected must be abandoned. . . . The report also shows that German airships have covered a distance equal to the distance from Germany to the British coast without replenishing fuel. . . . In favourable weather the German airships can already be employed for reconnaissance over vast areas of the North Sea, and one airship, owing to the extended view from high altitudes under favourable weather conditions, is able to accomplish the work of a large number of scouting cruisers. It is difficult to exaggerate the value of this advantage to Germany. By a systematic and regular patrol of the approaches to the coast, it will be possible in fair weather for German airships to discover the approach of an enemy and to give timely warning of attack, and if the approaches are reported free from the enemy the defenders of the ports and the crews of ships in these ports will be relieved for many hours from the intense and harassing strain caused by uncertainty as to the probability of attack.'<sup>1</sup>

<sup>1</sup> *The War in the Air*, vol. i, p. 181.

Further, the sub-committee was of the opinion that the large airships in the possession of continental nations, which were capable of carrying 30 persons, could lift a weight of bombs sufficient to destroy torpedo-craft, dock gates, power stations, magazines, and that they were far less dependent on favourable weather than was generally supposed.

'In short', they added, 'every one of the strategical and tactical advantages which the Committee of Imperial Defence anticipated in 1909 when recommending the construction of a rigid airship for the Navy, has been, or is in a fair way of being, realized by the German airships. These results have only been attained by perseverance under the most discouraging conditions of disaster and loss.'<sup>1</sup>

The report of Captain Sueter and Mr. O'Gorman impressed the authorities with the need of immediate action in order to prevent other nations from having air services superior to those of our own. We had then only two small Army airships, named *Beta* and *Gamma*, and a very small number of aeroplanes. With respect to aeroplanes, this action had been taken already, with the formation of the Royal Flying Corps. In regard to airships, which chiefly concerned the Navy, it was a question for the Admiralty to decide whether it was prepared to proceed with experimental work (of an admittedly expensive nature) or whether it preferred to neglect a device which might prove to be a determining factor in war. It chose the former of these courses and, as shall be told later, on September 25 (1912) reconstituted at Farnborough the naval airship section which had been disbanded on January 25 (1912) as an outcome of the disaster to *The Mayfly*.

At the end of July (1912) the Government decided to provide a system of air stations on the east coast of England and Scotland, which provision had already been advised in the report of the technical sub-committee to the Committee of Imperial Defence on April 25 (1912).

The value of the use of wireless telegraphy in naval aircraft had not been lost sight of by the Admiralty during this year (1912). In the early part of the year, as no machines were available for fitting, a wireless telegraphic station was constructed on Burntwick Island, Kent, the conditions being, as nearly as possible, those obtaining in an aeroplane. Stray signals were received from this station by H.M.S. *Actaeon* lying about a mile distant. During the naval exercises off Weymouth in May of the

<sup>1</sup> *Ibid.*, vol. i, p. 182.

same year, a Short hydro-aeroplane was fitted with a simple form of transmitter and receiver, with a range of between 3 to 5 miles. In June (1912) Commander Samson reported that, as a result of experiments with this machine, he had during the course of certain flights at Harwich been able to receive messages very clearly at a distance of 3 to 4 miles and, occasionally, up to 10 miles. He stated in his report that, 'if proper facilities are given, wireless telegraphy will develop into a quick method of imparting observations', and that 'the observer, if a trained man, can easily carry out both functions of observing and also signalling'—an opinion that subsequent experience has justified. In July (1912) the Admiralty decided that the full development of wireless telegraphy in naval aircraft necessitated at least one officer devoting his whole time to the subject, and accordingly Lieutenant Raymond Fitzmaurice, R.N., was appointed to conduct the necessary experimental work. The greatest bar to the success of these experiments was the want of apparatus that was at once efficient, light, and small enough to be carried in aircraft. As Lieutenant Fitzmaurice subsequently said:

'Up to this time' (July 1912) 'only one experiment had been carried out... and consisted of taking up a buzzer worked off dry cells: now cells are very heavy. . . . This first experiment was not very successful, a plain aerial was used, the aerial consisting of wires stretched across the front upper plane, and the earth wires taken from the observer's seat to the tail. Signals were heard at 3 to 4 miles, but it was evident that some other form of power than cells would have to be used if the range was to be increased to any great extent.

'Naturally, one tried to find some light and compact alternator which could be run off the main engines of the aeroplane, but on inquiry, no firm in England could offer any alternator of suitable size and weight.'

A few days after his arrival at Eastchurch he was instructed to proceed to Farnborough to take charge of the wireless telegraphic apparatus in the airship *Gamma* which was to be employed in the forthcoming Army manœuvres, and it was some time before he returned to Eastchurch and found 'the light and compact alternator' of his wish.

In September (1912) four naval pilots, by name, Commander Samson, Captain Gordon, R.M.L.I., Lieutenants Spenser Grey and L'Estrange Malone, R.N., took part in the Army manœuvres and, in spite of the bad weather at the time, were able to make valuable reconnaissances. It was soon found that for such reports to be of real value the observer must be a highly trained Army

officer, knowing the operations, and able to distinguish the number and composition of troops. These exercises, and the conclusions which followed them, are of interest, as it was in accordance with the declared policy that the Corps should be available for duty with either of the Services.

September also saw (as a result of the report to the Committee of Imperial Defence prepared by Captain Sueter and Mr. O'Gorman on their visit to the Continent in June (1912))<sup>1</sup> the reconstruction, on the 25th, of the naval airship section—disbanded on January 25 (1912)—and Commander E. A. D. Masterman, Lieutenants N. F. Usborne, F. L. M. Boothby, and H. L. Woodcock, and a small number of ratings were attached (September 25) to the airship squadron of the Military Wing at Farnborough, with the object of their gaining experience in the handling and maintenance of airships.

It was announced by the Admiralty on October 10 (1912) that it had approved the establishment gradually of a chain of stations for naval aircraft along the coasts of the United Kingdom within easy flight of each other, these stations to serve as starting-points and bases for naval aircraft working with the squadrons and flotillas at sea. It may be remembered that the report of the technical sub-committee of the Committee of Imperial Defence (April 25, 1912) had recommended that landing rights should be obtained at, or near, the following named places: North Berwick, Newcastle, Cleethorpes, Cromer, Harwich, Dover, Portsmouth, Plymouth, and the Lizard. In the Admiralty announcement of October 10 it was stated that, in addition to these places and the existing station at Eastchurch, the Admiralty had approved the establishment gradually of additional stations at Scapa Flow, Aberdeen, Cromarty, the Clyde, Filey, Weymouth, and Pembroke.

As soon as the decision of the Admiralty to establish these stations had been made, and after a preliminary reconnaissance of the Norfolk and Suffolk coast by officers of the Admiralty Air Department, Captain Sueter detailed Lieutenant L'Estrange Malone to proceed to East Anglia and to report in more detail on certain sites along the coast. He was accompanied by an official of the Admiralty Works Department, Mr. R. F. M. Pearson, M.Inst.C.E.

While the preliminary work in connexion with the founding of the coastal air stations was proceeding, progress in the Naval

<sup>1</sup> *Vide The War in the Air*, vol. i, p. 182.

Wing in other directions was being made, of which a brief account appears desirable. Shortly after the decision was made to found the stations, the Air Committee had under consideration the problem of a suitable design for a new non-rigid airship for naval duties. The result of this deliberation was the purchase of an airship (from the *Astra Société de Constructions Aéronautiques*, Paris) of the *Astra Torres* type. She came over in the spring of the next year (1913), and thereafter was known as *Naval Airship No. 3*. About the same time as the Admiralty ordered her it bought a smaller non-rigid airship—*Willows No. 4*—which passed into the naval service as *Naval Airship No. 2*. This airship was designed by Mr. T. E. Willows.

As already mentioned, November (1912) saw the formation, at the Admiralty, of the 'Air Department', with Captain Sueter as its Director. The function of this department was that of dealing with all questions relating to aircraft in connexion with the Navy. Shortly before this department was formed, it had been decided to divide the Naval Wing into two sections, namely, aircraft for fleet purposes and aircraft for patrol purposes, and the principal duties of naval aircraft had been detailed. These were:

1. Distance reconnaissance work with the Fleet at sea.
2. Reconnaissance work off the enemy's coasts, working from detached cruisers, or special aeroplane ships.
3. Assisting destroyers to detect and destroy submarines.
4. Detecting mine-layers at work or mines already laid.
5. Locating hostile craft in waters which have to be kept clear for our war and merchant vessels.
6. Assisting submarines in their look-out for vessels to attack.
7. Screening our Fleet and harbours from observation by hostile aircraft, by attacking the latter.
8. Preventing attacks on dockyards, magazines, oil storage tanks by hostile aircraft.

In view of the expansion in the flying services, it was desirable that the problem of supply should receive consideration, and during November (1912) a scheme was projected with regard to the manufacture of aircraft for the Military Wing by private firms, and it was decided that no general specification of the details of an aeroplane for purposes of tendering should be issued to such firms. In particular cases, where it might be found necessary to give orders to private firms, it advised that those selected should be furnished with an exact specification, and, in such cases,

all persons concerned, both in the manufacture and trials of the machine, should be bound to observe the provisions of the Official Secrets Act. The Admiralty policy, on the other hand, was more liberal, in that it encouraged private manufacturers, while making clear that it had no intention of relying on any particular firm for its aircraft needs. This policy proved to be a wise one, and one result was that at all times (until the pooling of manufacturers' productions when the Royal Air Force came into being) the machines belonging to naval units were superior to those belonging to the Army.

In December (1912) proposals were submitted for the construction of an aircraft-carrier. The design had been prepared by William Beardmore & Company, Ltd., the shipbuilders of Dalmuir, in consultation with Captain Sueter. The scheme was examined carefully by various heads of departments at the Admiralty, and their report was made some months later. Their observations indicated a strong feeling that the proposal was of such moment as to warrant a joint meeting of technical and naval officers with a view to considering and, if possible, improving the design. Unfortunately such a conference was never held. Had it assembled it is felt that there would have resulted an immediate improvement in an arrangement which, reviewed now in the light of subsequent experience, was singularly well thought out, although possessing certain undesirable features. The Air Department did, however, before the summer of the next year contribute to the solution of a difficult problem by developing a hydro-aeroplane with wings capable of being folded. Had the conference been convened the design of this particular machine probably would have been anticipated, and its adoption would have removed at once the chief disadvantage shown in the scheme of the proposed aircraft-carrier.<sup>1</sup>

The end of December saw the commissioning of the first seaplane station in the country—that at the Isle of Grain—under the command of Lieutenant J. W. Seddon, R.N. This station was destined to become identified mainly with experimental work.

It has ever been that the 'price of Admiralty' must be paid, and the truth of this was to be appreciated soon by the new arm of the Service, for, while Lieutenant W. Parke, R.N., was flying (December 11, 1912) a Handley Page monoplane from Hendon to Oxford, he 'crashed' and was killed. With him was Mr. Arkell Hardwick—Mr. Handley Page's chief assistant—who also was killed.

<sup>1</sup> Vide *The War in the Air*, vol. ii, p. 338.

## 26 THE EARLY DAYS OF AVIATION IN THE ROYAL NAVY

It may be mentioned that the onomatopoeic word 'crash', used in the literature of aviation, was coined by Captain J. D. B. Fulton of the Royal Field Artillery and Royal Flying Corps (who was originally one of the officers of the Air Battalion of the Corps of Royal Engineers). This officer also devised an instrument called a 'Crashometer', which made a record of the quality of the pupil's landing in case he (Captain Fulton) was not there to witness it.

By the end of 1912 some 22 commissioned officers, petty officers, and men of the Royal Navy and Royal Marines had obtained the Royal Aero Club Certificate and, in addition also, 30 officers had completed the first course at the Central Flying School at Upavon. The Naval Wing now had in its possession 16 machine—8 biplanes, 5 monoplanes, and 3 seaplanes; it also had one small non-rigid airship, *No. 2*—the erstwhile *Willows No. 4*.

In closing the record of the main events connected with naval aviation up to the end of 1912, it must not be thought that in a narrative which has an historical character the labours of civilians, either direct or related, in developing aviation and all that appertains thereto, independent of the Service, are ignored. Such is not the case. The record is one of Service development, and the civilian activities are mentioned only when they are associated with those of the Service.

## I

THE COMMISSIONING OF GREAT YARMOUTH  
AIR STATION

IT may be remembered that in the autumn of 1912 instructions had been given to Lieutenant L'Estrange Malone and Mr. Pearson, an official of the Admiralty Works Department, to prospect for a site suitable for an air station in Norfolk. The duties of these gentlemen 'were confined to reporting on certain specified sites already provisionally selected by the Admiralty Air Department', but they were 'at liberty to report on any other sites which they might find'. Lieutenant L'Estrange Malone's duties were 'to consider the site from the point of view of flying and personnel', and those of Mr. Pearson were 'to report on it from the engineering aspect, as to what its possibilities were as regards erection of slipways and buildings, provisions of water-supply, drainage, and similar matters'.

The whole question of launching and handling hydro-aeroplanes was in a purely experimental state at the time, and there was little experience to act as a guide in the selection of a suitable operating base for such craft. The Admiralty wished to find a place where a site on the shore could be leased at a low rental in the first instance, with the object of gaining experience by usage, before deciding to establish it as a permanent station. The general requirements of a hydro-aeroplane station had been outlined. These were, firstly, that the site was to be approximately 5 acres in area, with a water frontage of at least 150 yards; secondly, that it should be in the proximity of, or adjacent to, land suitable for an aerodrome; and thirdly, that a reasonably long lease of the property should be obtainable. At the same time it was not proposed to erect quarters giving sleeping accommodation, as the personnel were to be housed outside the station. The selected site, moreover, was required to offer reasonable facilities for launching machines from a slipway, and amongst the other desiderata were those that the sea in the vicinity should be as free as possible from shipping, and that there should be a harbour close at hand in which motor-boats could lie with safety at their moorings. Such motor-boats were required to assist the machines. Also it was considered desirable that the place should have good

railway access, and that there should be facilities in the neighbourhood for housing personnel.

When these two officers had furnished their reports it was decided by the Admiralty to choose the site at Great Yarmouth, which generally complied with the above conditions and was considered, on the whole, the most suitable in the county, though it was by no means perfect. At one time the Admiralty judged that Cromer might serve the purpose, but owing to the configuration of the shore in the neighbourhood it is very difficult indeed to launch without risk of damage a small boat, not to mention a hydro-aeroplane, and especially the machines of that day—by no means robust. Other sites in the neighbourhood of Great Yarmouth also were examined—one on the 'North Denes' between Caister and Great Yarmouth, and the other on the foreshore, south of Gorleston. However, after consideration, it was decided that the most suitable site was on the 'South Denes'. Before making the selection, the Admiralty approached the War Office to see whether or not there was any War Department land in the vicinity which might be suitable for the purpose, but there was none.

The suggested site at Great Yarmouth had the advantages that the Corporation were prepared to lease the land on favourable terms at a low rental; that the 'South Denes' were suitable as a landing-ground for aeroplanes; that accommodation for some of the personnel could be found in the local Coastguard station; and that lodgings were easily obtainable in the town. The last advantage was one of the factors that decided the choice, for on that Coastguard station were cottages which could be used to house the personnel of the Air Service. It may be mentioned that after the formation of these air stations it was hoped to take over some of the duties of the Coastguard Service and so effect an economy. Captain Sueter has stated since that what influenced him to some extent in his selection 'was being able to obtain Coastguard cottages at Calshot, Grain Island, Yarmouth, &c., as we had *no money* to build houses—every penny I could squeeze had to go in machines and sheds to house them in. If a seaplane site or aerodrome was not ideal we were forced to take it because of the housing difficulty.'

As soon as Lieutenant L'Estrange Malone and Mr. Pearson had reported in favour of establishing a site at Great Yarmouth, Captain Sueter made an inspection himself, approved the report, and recommended to the Admiralty that an air station be com-

missioned there as soon as possible. In due course the Admiralty agreed to this, and steps were taken to acquire the necessary land from the Corporation. A conference was held (February 25, 1912) between the officials of the Admiralty, the Town Clerk, and the Borough Surveyor. What happened afterwards can best be told by quoting the Minutes of the proceedings of the 'General Purposes Committee' of the Town Council (February 28, 1912). After reference to the conference previously mentioned the Minutes continue with the statement that:

'It appeared that the Admiralty would prefer the site on the South Denes. . . . This site, being about 5 acres in extent, lies between the Marine Parade and the Beach, and is about 1,000 yards south of the Nelson's Monument. That the Admiralty would only agree to pay rent based on a lease of the land at agricultural value, but that there would be certain buildings erected, and the staff would consist of 2 officers and 15 to 20 men. That it would be necessary to exclude the public from passing in front of the depot, when aeroplanes were being actually handled. That the Admiralty desired a lease from the Corporation of the site for a period of 21 years, determinable at the option of the Admiralty only at the expiration of the first 5, 7, or 14 years respectively at a rental of £2 10s. od. per acre per annum.'

The Committee, though in favour of the proposals, desired 'to make it clear that the rental of £2 10s. od. per annum on the whole site should be regarded as purely nominal and not as representing the value of the land in question'. Apart from this proviso, it acceded to the Admiralty's wishes. A month later the latter accepted the terms, and preparations were made at once to commission the air station.

Previous to this the South Denes had been used for the drying of fishing-nets, and a part of them also was used as a racecourse. It was arranged that, as far as possible, the Service would not interfere with these rights. It should be mentioned that, at first, it was intended only to have one land machine at the selected air station in this area—hydro-aeroplanes were to be supplied when they were available in sufficient numbers.

The sea washes the eastern shore of the Denes and, owing to the fierce tide, their contour is continually altering. At one period this shore may slope gently towards the sea, at another a miniature cliff may be formed, and these changes added to the difficulty of launching seaplanes. A mile or so out are the Scroby Sands, guarded by the St. Nicholas light vessel—beyond the Cross Sands, away to the north, lies the Haisborough, and to the south those of Corton. Despite this protection, heavy seas—

especially during easterly gales—break upon the shore, rendering it impossible to launch even heavy boats, much less seaplanes or flying-boats.

The Denes were not at all suitable as an aerodrome, as they have the disadvantage of being very narrow—roughly speaking, they are about a quarter of a mile wide and half a mile long. On the east side they are bounded by the sea, on the south by the harbour entrance, on the west by the River Yare, and to the north by 'Nelson's Column' and large numbers of 'herring-pickling' plots. To the north of this column lies the town of Great Yarmouth, and to the west of the River Yare a steep hill runs the whole length of the Denes. This hill is covered with houses, forming Gorleston village. Apart from the narrowness of the aerodrome, a high ridge ran down its centre; to the east of this ridge the ground offered good facilities for landing machines when the wind was blowing either from the north or the south. To the west of the ridge, however, the ground sloped down steeply to the river and was covered with deep holes. Encircling the whole aerodrome was a macadam road. Therefore, to the pilot unaccustomed to it, Great Yarmouth aerodrome was a difficult one to negotiate, for, viewed from the air, the ridge running down its centre was virtually invisible, and therefore, even when the wind was due south or north, he often found it by no means an easy matter to land a machine with success, and when the wind was blowing from the east or the west it required the exercise of considerable skill and judgement on the part of a pilot to land a machine within the precincts of the aerodrome. The difficulties experienced during the day-time, both in 'taking-off' and landing machines, naturally were increased greatly at night-time, for in the darkness the only guide that a pilot had for 'taking-off' his machine was the light of a torch held in the air by an air mechanic standing at the far end of the Denes. If there were a wind blowing either from the east or west, most pilots found it very difficult to keep a straight course in 'taking-off', and many found themselves in positions of extreme danger, as they missed by inches ships' derricks to the west, or the high masts carrying the wireless aerial to the east. When landing at night-time it also proved very difficult to counteract any drift of a machine, especially if it were heavily laden. A further obstacle to pilots coming in to land from the north was 'Nelson's Column', which, standing about 150 feet high, guarded the northern approach to the aerodrome. Application was made to the authorities to light the prongs of Britannia's trident (whose

figure surmounts the column), but this proposal was not approved by them.

These disadvantages have been pointed out, but not exaggerated, to show that, while the selected site offered many advantages, it was most unsuitable from the flying standpoint. Those who served at the station, however, triumphed over these difficulties.

As the station was used as a base for aeroplanes, seaplanes, and flying-boats, it may not be out of place here to give a description of some of the differences between flying a seaplane and an aeroplane. A large number of pilots assumed, during the War, that because they were trained and proficient in the art of flying aeroplanes, they could, therefore, handle seaplanes equally well. This over-confidence was the cause of a great many accidents. There were many cases of aeroplane pilots being transferred to the flying of seaplanes and, in the majority of instances, they proved quite unsuitable for the work, whereas, inversely, a seaplane pilot, having received his initial training in land machines, did not suffer from a similar disadvantage.

At first sight the advantage of having the sea as an aerodrome would seem to be overwhelming. On the other hand, it only requires one experience of sitting absolutely helpless on a sinking seaplane, say, 100 miles from assistance, to appreciate the fact that on land, even if the landing were to take place in enemy country, the pilot has some chance of living, whereas slow death by drowning in the middle of the North Sea can be left to the imagination better than it can be described. If death should take place during aerial combat or as the result of a crash, the pilot's thoughts are absorbed on other things than life, but to wait for hours, away from the enemy, contemplating the giving up of one's life, due perhaps not to enemy action but to a faulty magneto or a broken piston, is something that has to be experienced to be realized.

The alighting and 'taking-off' with a seaplane are different operations from those with a land machine, and the machines themselves differ. In the first place a seaplane has to be constructed more strongly than an aeroplane in order to enable it to resist not only the shocks experienced when alighting, but also to withstand the stresses set up when the blades of the tractor airscrew, revolving at high speed, strike the spray thrown up by the floats. Owing to the erosive action of the spray on the wood, all seaplane airscrews and propellers have to be covered with a

metal sheath along the leading edge and at the tips, for without this protection their life would be short. Therefore, because a seaplane has to be constructed more rigidly than a land machine, there is a tendency for it to weigh more, and it therefore requires a faster 'taking-off' and alighting speed. The seaplane pilot is faced with additional difficulties. If there be no wind, and the sea be perfectly calm, a very much greater 'ground speed' has to be attained (than if there be a wind) before the machine will gain sufficient flying speed for the wings to take some load off the floats, and eventually enable the machine to 'take-off' from the surface of the sea. Pilots did not always appreciate the fact that the landing speeds of land machines and seaplanes differed from each other. This was, in part, due to the practice of fitting different types of air-speed indicators in land machines to those fitted in seaplanes. The air-speed indicator in the former always read in miles an hour, whereas in the latter the speed was recorded in knots. A speed of, say, 100 knots equals a speed of approximately 115 statute miles to the hour, the difference between the two being due to the fact that a knot is a speed of one nautical mile, or 6,080 feet, an hour, as against the statute mile, or 5,280 feet, an hour. This 15 per cent. difference was not always appreciated, but was, of course, very important. During the War it was not an uncommon sight to see machines struggling over the surface of the sea, 'like swans with clipped wings', trying to attain sufficient speed to rise. A great deal depended on the skill of the pilot, for with the same machine some pilots could 'take-off', whereas others would 'taxi' vainly about, till all the water in the radiators of their engines had boiled away and the engine seized. On the other hand, if there were a breeze, instead of having a perfectly smooth aerodrome, the sea, with its waves, 'would be like an aerodrome filled with concrete ridges', the height of the concrete ridges being dependent on the size of the waves. It is a mistake to imagine that the sea is soft to alight on, and, owing to the fact that the floats of seaplanes were practically unsprung, the jar of alighting in a fairly rough sea was considerable.

In flying a seaplane off in rough weather, the pilot had to contend with the driving spray from the airscrew, and naturally, whenever the spray struck the airscrew, the revolutions of the engine would drop, and the machine would therefore start to lose any speed that she might have gained, all of which delayed the flight. Having succeeded in making his machine hydroplane on

her floats, the pilot's chief desire was then to 'pull' her off the water as quickly as possible. In a very large number of cases the pilot would, through over-anxiety, 'pull' his machine off too soon, and then, through the machine not having attained sufficient 'flying speed' to maintain her load, she would gradually 'stall'. The rear of the main floats probably would hit a wave, and the machine would bounce 20 or 30 feet into the air. The pilot would try again to maintain his machine in the air (still without sufficient 'flying speed'), with the inevitable result that she would 'stall'—one wing would drop and, a wing float striking the water, the machine would turn a complete 'cartwheel'.

In alighting, similar difficulties are experienced. If the sea be very calm, it is extremely difficult to judge the distance above the water. Where a pilot was alighting near the beach, he would, if he were wise, alight almost on the beach. If, however, the wind was an off-shore one, his best plan was to alight near some buoy. A wise commanding officer who had under his command inexperienced pilots would generally order a motor-boat (which was always in attendance off the slipway) to proceed at full speed in order that her wake might offer some guide to the pilot. Even with such guidance, many pilots were killed before or during the War, either through alighting 'too high up', i.e. thinking that they were just above the surface of the water, when as a matter of fact they were about 50 feet above it, or through their trying to alight 50 feet 'below the water', i.e. thinking they were higher than they were, and as a result flying straight into the water.

If the sea were very rough, even the best 'three-point' alighting would sometimes end in disaster, for on some occasions, just as the machine was alighting, the tail float would come in contact with a wave and either be ripped clean off or smashed in like an egg-shell. If the pilot were near land he might be able to 'taxi' quickly to the slipway or beach his machine. Frequently, the pilot would stove in a portion of the bottom of the main floats of his machine. These floats were built in watertight compartments, which naturally took some time to flood, and therefore, if a pilot found his machine 'settling down' he would 'taxi' as fast as he could for the beach. When at sea all these difficulties were increased greatly, for in a forced alighting on an oily, perfectly calm sea, a pilot had nothing to guide him, and in some instances could not see even the horizon, because under certain conditions the sea and sky blend together. He also might be forced to alight in thick fog, or in a heavy sea.

Another great difference between the flying of seaplanes and aeroplanes is the entire absence of any guiding mark when once at sea. When flying in an aeroplane over land there are usually railways, woods, villages, rivers, lakes, and innumerable other objects to be seen in the countryside below, which give the experienced pilot an idea of his position. Furthermore, he can check his 'drift' and his course before he leaves the neighbourhood of his aerodrome. A seaplane pilot, once he has left the coast, has no marks to indicate his direction, and his course has to be steered as with a ship at sea, entirely by compass. This, of necessity, means that the pilot must concentrate his attention on his compass, if he is to patrol with accuracy the area directed by his orders, for naturally the slightest deviation from his course will take him a long way out of his patrol area. The accuracy which some pilots developed in this respect was amazing, especially in the long patrols from Great Yarmouth and Felixstowe to Terschelling, Norderney, and Borkum. When starting out from Great Yarmouth they would strike the Haaks light vessel lying off the Dutch coast, and on the return journey they would find themselves heading direct for Nelson's Column when this came into view, either over the horizon or, if misty, protruding out of the mist, when the rest of the air station and Great Yarmouth were shrouded in fog.

A westerly wind was the cause of the loss of many inexperienced pilots. Not realizing the distance that they were covering, they would set out on patrol from Great Yarmouth only to find on their return flight that, not only had they flown far past their allotted turning-point, but that they were flying against a stiff breeze which was blowing them out over the Dogger Bank, and so preventing them from making land again. Fortunately these losses were reduced considerably during the latter years of the War, owing to the introduction of a carrier pigeon service, for a pilot on alighting would release a pigeon with a message attached to one of its feet stating that he had been forced to alight owing to lack of petrol or some other cause, giving at the same time his approximate position. A patrol could then be sent out to endeavour to effect his rescue.

Returning to the main theme of this story, the Admiralty announced on Saturday, April 13, 1913, that amongst the naval appointments made on that day were those of:

'LIEUTENANTS R. Gregory to the *Actaeon*, additional, as Squadron Commander, for Command of Yarmouth group of Air Stations, and C. L.

Courtney to the *Actaeon*, additional, as Flight Commander, for Yarmouth Air Station, to date April 15th.

'ROYAL MARINES. LIEUTENANT T. S. Cresswell to the *Actaeon*, additional as Flying Officer, Yarmouth Naval Air Station, to date April 1st.'

The next day *The Times* newspaper announced in the following terms the formation of Great Yarmouth (and Harwich) air stations:

'The Admiralty have given instructions for naval air stations to be constituted to-morrow at Great Yarmouth and Harwich on similar lines to the naval station commissioned on the Isle of Grain on December 31 last. It has already been announced in *The Times* that a new station was to be established at Yarmouth.

'Yarmouth air station will form the centre of a group of stations on the East Coast, and will be placed under the command of Lieutenant R. Gregory who holds the grade of squadron commander in the Naval Wing of the Royal Flying Corps. Lieutenant C. L. Courtney, R.N., who joined the Naval Flying School at Eastchurch from the battleship *Commonwealth* on August 19 last year for a course of aviation instruction, and who on January 7 last was graded as a flying officer, will take over to-morrow the duties of flight commander at the Yarmouth station, which Lieutenant T. S. Cresswell, R.M.L.I., who has just completed a course of training at the Eastchurch Flying School, will join as flying officer. . . .

'The new stations will be equipped with the latest types of machines, and when commissioned the Admiralty will have four air bases, the other two being on the Isle of Grain (facing the estuary of the Thames and Medway) and at Calshot, near Southampton.'

Calshot air station had been commissioned a few days before this announcement, with Squadron Commander Spenser Grey, R.N., as its commanding officer. The air station at Harwich was really at Felixstowe, on the shores of Harwich harbour, opposite to Harwich and Shotley.

Great Yarmouth air station was commissioned on April 15 (1913), and the three afore-mentioned officers were posted and about five naval ratings were drafted to the station. They all found their own lodgings, and the official head-quarters were in the town, at 25 Regent Street. The work of erecting the first hangar, of the Royal Aircraft Factory type—a canvas and steel structure—was started at once.

The first machine to arrive at the station was No. 69 (Maurice Farman land biplane), piloted by Lieutenant Courtney, and she arrived there on May 31, having been flown from Hendon. This machine was a standard so-called 'Military Biplane' and, equipped

with a 70 b.h.p. Renault engine, had a maximum speed of 54 miles an hour. These machines were then built by the firm of Aeroplanes Farman, Bittancourt, Bul, and Étampes, which was represented in this country by The Aircraft Manufacturing Company, Ltd., who built machines of this type under licence at Hendon. The machines were of the 'pusher' type with interconnected front and rear elevators; lateral control was obtained with interconnected ailerons. The undercarriage was of the combined wheel and skid type, and the latter curved up until it met the front elevator. Their useful load was about 620 pounds, and they could seat two persons in the covered-in *nacelle*, with the pilot in front. Popularly they were known as 'Longhorns'.

Naturally, great interest was shown in her by the townspeople—an interest heightened, so they said, by the hope that she would add to the town's attractions for its summer visitors. The story of the arrival of this machine may be told by quoting from the accounts that appeared at the time in the local press:<sup>1</sup>

### YARMOUTH'S FIRST FLYING MACHINE

Fine Flight from Hendon

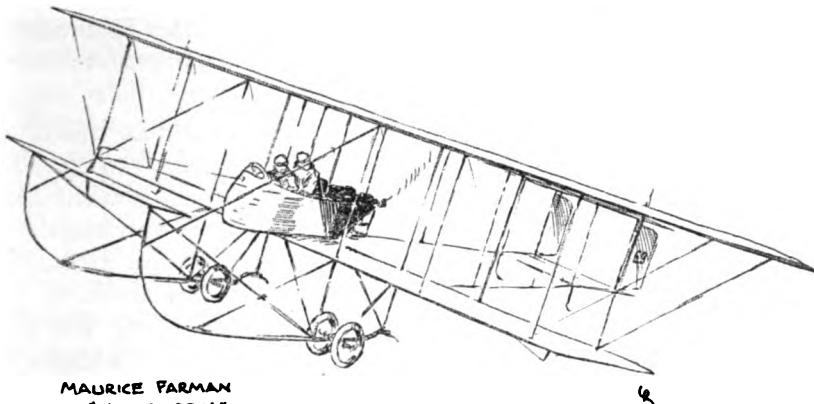
Average Altitude of 2,000 Feet

'Of the disappointed little crowd of people which had assembled on the South Denes, Yarmouth, on Friday evening, between seven and eight o'clock, in the hope of witnessing the arrival of the first flying machine to be attached to the newly constituted naval aircraft station, only those intimately in the know were aware that the expected flight had been postponed until Saturday morning. The weather conditions had rendered a temporary cancellation of the proposed flight, but the officers of H.M. Flying Corps are not slow to grasp favourable opportunities—as the future developments of the Yarmouth Aviation Station will prove—and so Lieutenant Courtney (Flight Commander of the Station) and an experienced mechanic named Hackney boarded one of the most recently constructed biplanes at Hendon aerodrome on Saturday morning just before seven o'clock and started on what proved to be a remarkably fine trip to Yarmouth. On the route the biplane passed over Chelmsford, Witham, Colchester, Ipswich, Woodbridge, and Saxmundham. Just outside Lowestoft, about half-past eight, the machine ran short of petrol, and a temporary descent was necessitated in a field near Carlton Colville. Having been thoroughly replenished, the ascent was accomplished in equally as fine a fashion as the descent had been made, and the journey was resumed at about twenty minutes to ten. Yarmouth was reached at ten o'clock, a graceful descent being made on the Denes, south of the Nelson Monument. In its present condition the Denes

<sup>1</sup> *The Yarmouth Independent*, June 17, 1913.

cannot be described as one of the best landing places for aircraft. There are too many fishing nets strewn about, and it will readily be understood these do not tend to secure the greater safety of either aviator or machine. Still, the officers of the Yarmouth station are not oblivious to the fact that the nets belong to people concerned in the town's principal industry, and their interests are to be respected. Throughout Saturday morning's journey, Lieutenant Courtney maintained an average altitude of 2,000 feet, and the distance from Hendon to Yarmouth was covered in satisfactory time.

'The biplane which Lieutenant Courtney piloted to Yarmouth on Saturday morning is not one of the orthodox machines for naval aviation stations. Hydro-aeroplanes are the things, and two of these are expected to be com-



MAURICE FARMAN  
"LONGHORN"  
70 HP Renault.

pleted for the Yarmouth station before the middle of August. The biplane, which is purely a land machine, will, however, serve a useful purpose, and, to quote the words of Lieutenant Courtney, "it will be brought out for flying as often as possible, due regard always been paid to the weather". At the present time the strength of the Aviation Station is two officers and five men. All are experienced in aircraft, and many flying exhibitions such as that which Lieutenant Courtney obliged on Saturday, and upon which he is to be congratulated, may be expected during the ensuing summer months. Visitors to the town will find the new station a considerable source of interest. As we have indicated, flights may be expected pretty frequently, but from what we gather it is not intended to make any previous announcements concerning them. The officers are not anxious to cause any disappointment to the public on that score.'

A few days later certain town celebrities were taken for short flights.

After the preliminary work, all those at the station settled down to the task of making it ready for its future duties. Exactly a month after the Maurice Farman machine arrived, it suffered its

first crash, when Lieutenant Cresswell had a forced landing near Hopton. The machine, however, was repaired speedily and flown back to the station. The work of enclosing the aerodrome, together with the building of permanent sheds, proceeded. As one officer remarks in his reminiscences:

'The enclosure was eventually surrounded by high corrugated iron railings, for we were all imbued with the secret nature of our aircraft in those days, in fact, our night-watchman, the naval pensioner, Deary, was assisted by a fierce Airedale dog, supplied by the thoughtful Admiralty, and many the casual stroller who lost the best part of his nether garments in an encounter with this beast. I well remember taking delivery of the dog at the railway station, where I found him chained to a pillar, surrounded by an apprehensive group of porters and inspectors, all standing at a respectful distance from him.'

This dog, 'Bob', was reported on by the commanding officer of the air station (Lieutenant Gregory), and the report ran that 'he hears the slightest sound long before the watchman himself does and will lead him straight to the source of it. It is well known in the district that it is dangerous to enter the station at night'. Apparently 'Bob' became too zealous in 'the execution of his duty', for eventually he had the distinction of being the first casualty at the station, although he was tactfully logged as 'missing'.

On May 7 (1913) an event of considerable importance to the Naval Wing occurred, for H.M.S. *Hermes* was commissioned in succession to H.M.S. *Actaeon* as the head-quarters of the Naval Wing, with Captain G. W. Vivian, R.N., in charge of naval coastal air stations. In the Admiralty announcement of this step it was stated that the *Hermes* was to 'commission on the 7th May as parent ship of the Naval Air Services'. As mentioned previously, this was the term that was used generally to describe the Naval Wing. It was not, however, till July 1914 that the Royal Naval Air Service came into its own as a separate entity. In the order to which reference has been made it was said that officers and men, both of the aeroplane and airship sections of the Naval Wing, would be borne from that date on the books of the *Hermes*. The commanding officer was to take over from the commanding officer of the *Actaeon* all the duties in connexion with the Air Service hitherto performed by him. He was to be under the strict orders of the commander-in-chief at the Nore, but could correspond departmentally with the Air Department at the Admiralty. Officers in charge of air stations were respon-

sible to the captain of the *Hermes* for the general conduct of their station, and for its efficiency as part of the Naval Wing, and such officers outside the Nore Command were to be responsible to the captain of the *Hermes*. The torpedo boat No. 23 was detailed also from the Nore Defence Flotilla for service with this ship. In connexion with the manning of the *Hermes*, the term 'air mechanic' was used, though the captain was careful to state that 'the term "air mechanic" is in use, though no such naval rating really exists. By air mechanic is meant a man who has been through a course of training either at the Central Flying School or at Eastchurch.' This is a matter of interest, as it showed the infiltration into the official language of newly coined words. The *Hermes* continued to act as a seaplane-carrier till October 30, 1914, when she sank off Calais, as a result of being torpedoed by a German submarine.

Turning to the affairs of Great Yarmouth air station, the principal work for the next month or so was that of preparing the station for the reception of its new machines and staff. In June (1913) the first motor-boats were sent to the station—the *Marquerite* and *Quest*—together with a Service dinghy. The purpose of these boats was to act as tenders to the hydro-aeroplanes that were to arrive soon. It may be of interest to state that when the question of moorings for these craft first arose at Great Yarmouth, the Port and Haven Commissioners said that the motor-boats might 'be moored at the Quay adjacent to the Trinity Corporation's Explosive Magazine'. The crews of these boats always felt that behind this proposal there was a sinister intention. This problem of moorings was raised in the month of June (1913) because the naval manœuvres were to be held in July (1913), when aircraft from Great Yarmouth air station were to be used. Owing to the local conditions, it was one of considerable difficulty. Finally, however, it was decided to lay the moorings out opposite the station, and also, if possible, to moor hydro-aeroplanes on the 'hard' in the harbour mouth.

Up till now it has been necessary, in order to preserve historical accuracy in this narrative, to use the term 'hydro-aeroplane' when describing a machine that was designed to arise from and alight on the surface of water. Owing to its cumbersome sound it was not popular, and for some time quite a fierce controversy had raged as to what term should supplant it, and many and strange were the suggested alternatives. The Admiralty decided to use the word 'seaplane', and this was announced officially on

July 17 (1913), when the First Lord of the Admiralty (Mr. Winston Churchill) stated in the House of Commons, in answer to Mr. Arthur Lee, that 'we have decided to call the naval hydroplane a seaplane, and the ordinary aeroplane or school machine, which we use in the Navy, simply a plane, which is, I think, an effective method of description'.<sup>1</sup>

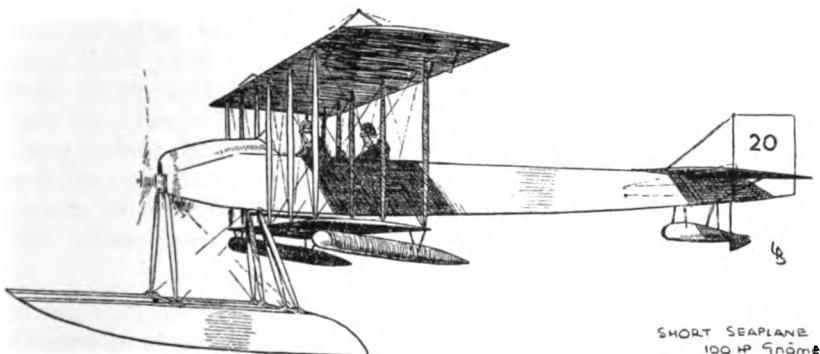
Preparations were being made now by all officers and personnel of the Naval Wing for the part it was to play in the forthcoming naval manoeuvres. The First Lord of the Admiralty (Mr. Winston Churchill) stated in the House of Commons (July 17) that, while there were a number—'much more than seventy-five'—of trained pilots available, the number of machines in existence was not so great as he had hoped once would be the case.<sup>2</sup>

The previous month it had been decided, in view of the expansion of the Imperial German Naval Airship Service, to allocate funds for the construction of two rigid and six non-rigid airships for the Royal Navy. The former were to be of the Zeppelin type. One was to be built by Vickers Sons & Maxim, Ltd., and the other in Germany, while of the latter, three were to be of the German Parseval and three of the Italian Forlanini pattern. In June an order for one airship of the Parseval type was placed in Germany (with *Parseval-Luftschiffe der Luftfahrzeug G.m.b.H.*), and two with Vickers Sons & Maxim, Ltd. One of the Forlanini type was ordered from the Italian makers (*La Società Leonardo da Vinci*), and the two others from Armstrong, Whitworth & Company, Ltd., who held a licence to manufacture this type of airship. This programme of construction was not sanctioned without some opposition, as the disaster to *The Mayfly* had not been forgotten. Not all these airships passed into the naval service. The one of rigid type, built by Vickers Sons & Maxim, Ltd., was commissioned, after many vicissitudes, at the end of 1916, as H.M.A. R. 9, but the one ordered in Germany never materialized. At the outbreak of war the Italian Government appropriated the nearly completed Forlanini airship, and those ordered from Armstrong, Whitworth & Company, Ltd., never came into being. The Parseval airship, ordered in Germany, was likewise never delivered, but Vickers Sons & Maxim, Ltd., eventually completed the two ordered from them. The work of establishing sheds for certain of these ships was started (in July 1913) at Kingsnorth, on the Medway, although this station was not commissioned until April of the following year.

<sup>1</sup> The Parliamentary Debates, 55 H.C. Deb. 55, p. 1501.

<sup>2</sup> Ibid., p. 1579.

Rapid progress was now (July) being made at Great Yarmouth with permanent buildings for the air station, and new machines and pilots were arriving. Of the seaplanes, one was a 100 b.h.p. Gnome-engined Short, a float machine with wing-tip floats under the lower plane and also a small tail float with a water rudder. All the floats had watertight compartments. This machine had two seats, with the pilot in front, while the observer's seat could, if necessary, accommodate two persons. The other two seaplanes were of French origin and manufacture, namely, Farman and Borel. The former was, in general, the makers' standard land machine, with the addition of floats, while the latter was a mono-



plane which owed its origin, in the first place, to Léon Morane, the celebrated Blériot pilot. She had a 'monocoque' body, the main floats were not provided with hydroplane steps, and the tail float was interconnected with the rudder. The two main floats had rowlocks, as it was thought that the machine could, if necessary, be manœuvred on the water by means of oars—an idea eventually disproved. The engine, an 80 b.h.p. Gnome, was fitted with a 'self-starter' operated by hand from the pilot's seat. Two other machines came to the station in July (1913)—a Sopwith biplane and a Caudron seaplane. The former was a two-seater tractor machine (a 'Tabloid') fitted with a French engine—a 100 b.h.p. Anzani. The latter was a biplane, equipped with an 80 b.h.p. Gnome engine, and had a monoplane tail with two vertical rudders, one above and the other below the tail. She was fitted with two stepped floats and an opening was formed in each float at the rear of the step, in which was mounted a running wheel. Two triangular floats were also fitted under the tail, together with two short skids.

The following account, written by a rating who was there, gives some idea of the conditions at the station at this period:

'The machines we had in July 1913 were: Short seaplane (No. 20), 100 h.p. Gnome. Sopwith seaplane, Anzani engine. Maurice Farman ("Longhorn"), Renault engine.

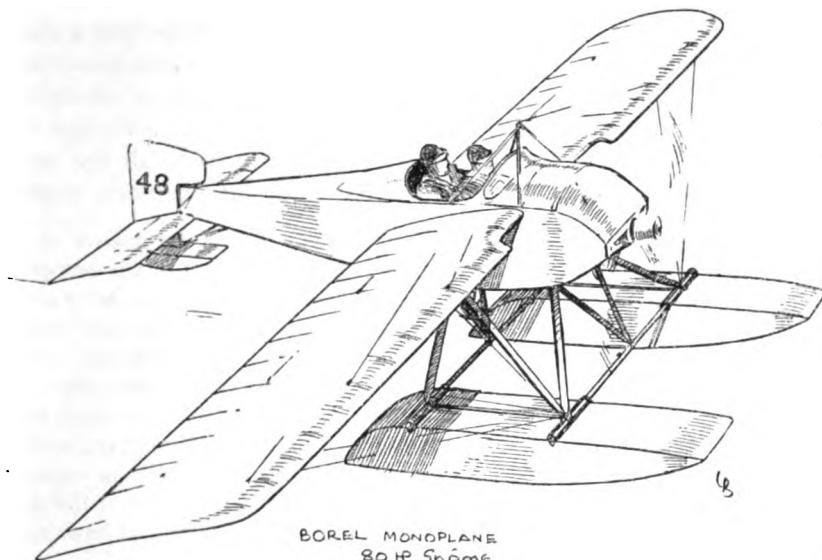
The first two sheds were erected immediately opposite the north slipway in which these machines were housed. The Ship's Company were placed on full "Compensation and Lodging" allowance and were taken to and from the station in a hired motor-car of uncertain age from St. John's Garage. The conveyance of the ratings by this means was not for their convenience, but only so as to get them down bright and early to work, usually at day-break. The Ship's Company became very popular with the townsfolk and free passes to the piers and similar places of amusement were served out. Visitors were permitted to see the few machines we had, on Sunday afternoons. Crowds flocked around the seaplane when day-flying was in operation, and many persons spoiled best suits in helping machines into the sheds, so as only to have a look inside them. Their humorous remarks, and comic explanations by the mechanics when questioned as to the various uses of parts of machines, such as this: "What is this for?" pointing to a tail float. "For storing brandy in case of crashing at sea", and, "What is this machine called?" "Short' seaplane."—"Well, what must the long ones be like?" gave us joy.'

The preparations at the air station for the naval manœuvres were completed now, but a digression must be made in order to give some account of the progress that had been achieved in the application of wireless telegraphy to aircraft in the Naval Wing. This is necessary because the function of the machines at these manœuvres was to be purely that of reconnaissance.

It may be remembered that in July of the previous year (1912) Lieutenant Raymond Fitzmaurice was appointed for wireless telegraphic duties with the Naval Wing. At the time of his appointment he was unable to obtain from English manufacturers 'a light and compact alternator which could be run off the main engines of the aeroplane'. In the same year, however, the engineer (M. Lucien Rouzet) to the Eiffel Tower wireless telegraphic station invented a transmitting apparatus which, in proportion to its power, was lighter in weight than anything that had previously been in use, and Lieutenant Fitzmaurice obtained permission from the Admiralty to go to Paris in order to see the set. Afterwards he described the subsequent experiments he made with the apparatus as follows:

'It appeared to me to be the very thing. It was light (70 lb.), compact, and beautifully made; it emitted a clear, musical note, and was in every way a

modern installation of exceptional lightness and compactness. It had been tried in one French aeroplane with successful results. The Admiralty at once purchased four sets, and M. Rouzet agreed to come over and help us to instal it on the first machine. At that time we were exceedingly hard up for aeroplanes, and those available for flying at Eastchurch consisted of a few small school machines, entirely unsuitable for taking any extra weight; also one experimental twin-propeller machine which no one liked; this machine was, however, the only possible one to which an apparatus could be fitted, and even then it had to be fixed on a platform outside the fuselage and



streamlined in. The installation consisted of: a self-exciting alternator of  $\frac{1}{4}$  k.w. power. A air-cooled transformer which transformed the alternator's current of 110 volts up to 30,000 volts. A spark gap of special design which emitted a clear, musical note. A tuning coil, primary and secondary, for altering the wave-length. An aerial reel for letting down and raising the aerial, signalling key, safety cutter and clutch for clutching in and out the alternator from the main engines of the aeroplane. According to the wave-length used, you let out from 100 to 400 feet of aerial wire, the weight (1 lb.) on the end keeping the trailer clear of everything. The earth consisted of a single wire under the upper plane and to the tail, forming a triangle.'

Their first trials in a machine were conducted over Dover and were a success, for signals were quite clear up to 20 miles. He found subsequently that:

'The ordinary tuning is impossible in an aeroplane when flying, as it is not possible to work a wave-meter, owing to lack of space and vibration, so one has to tune on the ground and then tune by ammeter when flying.'

'The tuning in the air is done by letting out or taking in aerial until the ammeter gives a maximum swing; on getting a maximum swing, you know that you have the right amount of wire out for the particular primary wavelength you are tuned to.'

'The tuning on the ground is not satisfactory, as conditions when in the air are quite different directly you are high enough up to be out of the influence of the earth.'

Subsequently, during some experiments this machine was crashed as a result of a forced landing, but the wireless telegraphy set was not damaged. Three days after this crash he 'got a letter from a Lieutenant Commander of a destroyer 45 miles away from us at the time of our experiments, enclosing a copy of all signals we had made . . . this destroyer had no previous knowledge that we were going to experiment, so the results were all the more satisfactory'. Lieutenant Fitzmaurice said, furthermore, that:

'the great difficulty in advancing wireless telegraphy in aeroplanes at this time was due to the entire lack of knowledge on the part of the aeroplane makers in things W/T, and it became necessary to get the Admiralty to put W/T requirements into the original specifications for its machine and to go round personally to every Admiralty contractor and explain that a machine built originally without a view to taking W/T was often impossible to fit with W/T after delivering. . . . The Admiralty gave me a free hand with all firms to settle with them details of construction, so long as the fundamental principles of the specification as regards lifting capacity, duration of flight, speed and climbing powers were adhered to; at the same time, it became very difficult to add an extra 70 lb. weight and have sufficient room in the machine for the W/T apparatus without sacrificing some of the above conditions.'

This and kindred difficulties have never yet been, and probably never will be, overcome to the satisfaction of all concerned. During May 1913 he tested an installation in *No. 20* Short seaplane (piloted by Sub-Lieutenant J. T. Babington) which immediately afterwards was sent up to Great Yarmouth air station. His experiences in these trials are of interest:

'She was finished in time to carry out W/T trials and take part in escorting the Royal Yacht the last 50 miles of her journey back from Flushing to Port Victoria after the German wedding. We proceeded to sea in the morning and flew out in the direction of Flushing and picked up the Royal Yacht about 20 miles to seaward of the Foreland. We gave them a W/T salute, the first W/T message the King had ever received from aircraft, I think. The apparatus worked excellently, and our base at Grain had us in good touch all the time we were away, the distance being about 50 miles.'

Afterwards he decided, for the time being, to give up the idea 'of reception in aeroplanes, as the roar of the engines and the vibration of the machine made it impossible to receive with any known receiving apparatus, and there was plenty to do in the meantime in developing transmission'.

It was not till some two years later that the difficulties of reception were on their way to solution. It is within our knowledge, however, that our experiments in both transmission and reception of wireless messages had met with greater success than the work towards a similar end in the German Air Service. This lead was maintained throughout the War, as our late opponents have admitted.

THE NAVAL MANŒUVRES OF 1913 AND THE PART  
PLAYED BY GREAT YARMOUTH AIR STATION

THE manœuvres of July 1913 have become historic in that, for the first time, aircraft were used in the Royal Navy with the fleet at sea.

The forces engaged were divided into two opposing fleets known as the *Red* and *Blue*. The former was under the command of the Second Sea Lord, Vice-Admiral Sir John Jellicoe, who flew his flag in the battleship *Thunderer*, and the latter fleet under the Third Sea Lord, Admiral Sir George Callaghan, flying his flag in the battleship *Neptune*. The umpire was Admiral of the Fleet Sir William May, aboard the cruiser *Euryalus*.

On July 10 (1913) the Admiralty announced that 351 of His Majesty's ships would take part in the manœuvres, and of these the *Blue* fleet would have 239 to the 112 of the *Red* fleet. The former were to be stronger in all classes of ships. In battleships this preponderance was to be 60 per cent., in battle cruisers *Blue* were to have 3 to *Red*'s 2, and the former were to have five times as many cruisers and twice as many light cruisers. In destroyers *Blue* were to have 100 to *Red*'s 60, and 30 submarines to *Red*'s 18, and the latter were to have only a third of the former's strength in 'other vessels'. The *Red* fleet, however, had a seaplane-carrier—the *Hermes*—a type of vessel which was not represented in the fleet of her opponent. The size of the two fleets very nearly reproduced the actual conditions of relative strength between the Royal and Imperial German Navies, except in the matter of light cruisers, where our actual predominance in strength was 60 per cent., and in submarines, in which we had a preponderance of 46 boats, instead of the 19 allowed to the *Red* fleet.

The manœuvres excited great interest in German naval and military circles, for, in the words of one of their military writers,<sup>1</sup> 'the theatre of operations, the conditions of the interesting problem set by your new War Staff, the relative strength of the *Blue* and *Red* fleets, and many other circumstances continue to make it perfectly clear that we were *Red* and you *Blue*'.

<sup>1</sup> Vide letter from 'Colonel Donner und Blitzen' to the military correspondent of *The Times*, August 27, 1913.

Some Members of the House of Commons held similar opinions to this gentleman and questioned the First Lord of the Admiralty (Mr. Winston Churchill). The latter replied (July 16) to one of his interrogators—Mr. Hunt—as follows: 'In accordance with custom the opposing sides in the coming naval manœuvres will be "Blue" and "Red", imaginary countries with imaginary objects, and I would deprecate the Honourable Member's attempt to add a further element of imagination.'<sup>1</sup>

*Blue* territory consisted of the United Kingdom and Ireland, with the exception of that part of the coast which extends from Great Yarmouth southwards to Dungeness, while *Red* territory extended south of this line, and included the coastline south of Great Yarmouth and round to Dungeness.

On the declaration of 'war' (at 4.0 p.m. July 23) it was known to *Red* through neutral information that one *Blue* fleet was cruising off the Scottish coast, with its head-quarters at Rosyth, while another *Blue* fleet was off the west coast of Scotland. *Red* also received information from merchant vessels that they had sighted *Blue* cruisers and destroyers at sea to the eastward of the Scottish and north-east coast. *Blue*, on the other hand, knew from reports that most of the *Red* battleships were in Dover Harbour, but that four of them had arrived from the Mediterranean off the entrance to the English Channel.

The 'general idea' behind the operations was that *Blue* knew that *Red* had all, or any, of the following objects in view. His fleet might cover military raiding parties on *Blue*'s coast, the raiding vessels being either unescorted or only under sufficient escort to drive off hostile torpedo craft. He might try to interrupt the Atlantic trade, which was of great importance to *Blue*. If *Red* pursued the latter course, it was assumed that he would use an anchorage off the west coast of Ireland. Naturally, the object of the *Blue* fleet was to prevent the success of any or all of these operations by bringing *Red* ships to action wherever it could do so with any prospect of success.

One of the questions offered for solution was concerned with the possibility, or otherwise, of landing, under certain conditions, a raiding party several thousands strong in the face of naval opposition and with the prospect of the raiders' communications being cut if they did succeed in effecting a landing. It was desired also to test the value of aircraft reconnaissance in such a scheme of operations, and also to see whether, and in what manner, the

<sup>1</sup> The Parliamentary Debates, 55 H.C. Deb. 55, pp. 1223-4.

The *Red* fleet had four lightly armed transports with it—the *Rohilla*, *Rewa*, *Dongola*, and *Plassey*—for the transport of the raiding troops. These troops consisted of one battalion of Royal Marines and three battalions of infantry. Attached also to the *Red* fleet was the seaplane-carrier *Hermes* (Captain G. W. Vivian) with her base at Great Yarmouth. She was specially fitted out to carry three seaplanes (actually, she carried only two), was provided with a launching platform on the forecastle and suitable derricks for hoisting machines in and out, and carried aeronautical stores to enable her to proceed to any point ordered by the commander-in-chief (*Red*) and launch her aircraft to scout. In addition, *Red* had Great Yarmouth air station (under the command of Squadron Commander Gregory), which at that time had three seaplanes and one aeroplane in action, namely:

- No. 20.* Short seaplane, fitted with W/T 100 b.h.p. Gnome engine.
- No. 29.* Maurice Farman seaplane, 70 b.h.p. Renault engine.
- No. 84.* Borel seaplane, 80 b.h.p. Gnome engine.
- No. 67.* Maurice Farman land machine, 70 b.h.p. Renault engine.

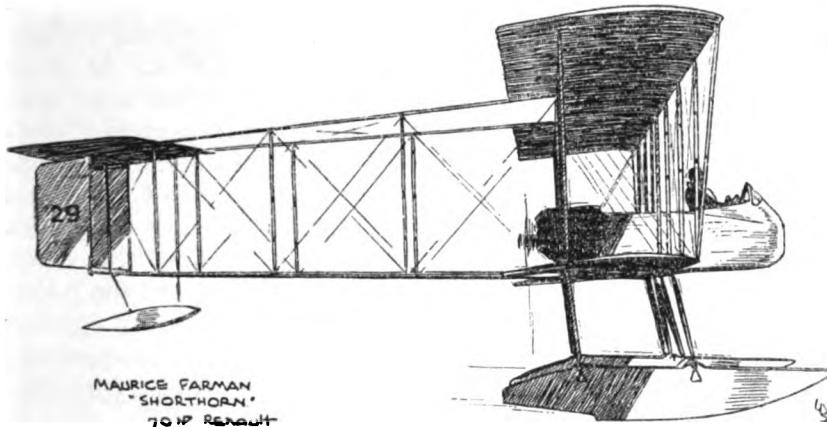
Commander Samson was aboard the *Hermes*, and, in addition to Squadron Commander Gregory, there were at Great Yarmouth air station four other pilots—Lieutenants C. L. Courtney, J. W. Seddon, R.N., T. S. Cresswell, R.M.L.I., and Sub-Lieutenant F. E. T. Hewlett, R.N.

*Blue* had the air stations at Leven (Firth of Forth) and Cromarty (under the command of Lieutenant A. M. Longmore, R.N.). The pilots at these two stations were Captain R. Gordon, R.M.L.I., Lieutenant D. A. Oliver, R.N., and Lieutenant C. E. H. Rathborne, R.M.L.I. *Blue* had no aircraft-carrier. Each of these air stations was supposed to have three machines, but owing to a strike of dockers at Hull the Borel monoplanes arrived too late from France for the opening of the manœuvres. The duty of the *Blue* air stations was to locate any of the enemy who came within their range, which was considered to be about 100 miles.

All the aircraft taking part in the manœuvres, together with the *Hermes*, were considered to be immune from attack, and were not permitted to make attacks themselves—the duties of aircraft on both sides were restricted entirely to reconnaissance. With a

view to introducing, as far as possible, the conditions which would have held had *Red* possessed an airship capable of a flight of 800 miles, the *Hermes* was allowed to proceed to any point within a 300-mile radius of Great Yarmouth and to send up her machines to reconnoitre. She must, however, return to Great Yarmouth Roads within a period of 48 hours from the time of her starting. She was not allowed to transmit information by wireless telegraphy to *Red* ships or bases, but she could employ 'visual signals' for this purpose.

The *Hermes* left Sheerness for Great Yarmouth on July 18.



Three days later, in a moderate sea, she launched, in the forenoon, her Short seaplane No. 81,<sup>1</sup> with Commander Samson as the pilot, who made a successful flight, which flight was repeated in the evening. The *Hermes* carried also a Borel monoplane, No. 48, which failed to get off on the same day, with the result that she was hoisted aboard and the position of her engine altered and 'the machine again put into flying trim'. Two days later (the 23rd), when the *Hermes* met heavy weather, this machine (which was carried forward) came to grief and was completely wrecked. Her place was taken on July 24 by the Caudron seaplane No. 55.

Although the actual movements of ships and the actions fought do not directly concern this narrative, a brief account of such operations will be given in order that the part played by aircraft may be understood more easily.

The fleets put to sea in very bad weather on July 23, and their

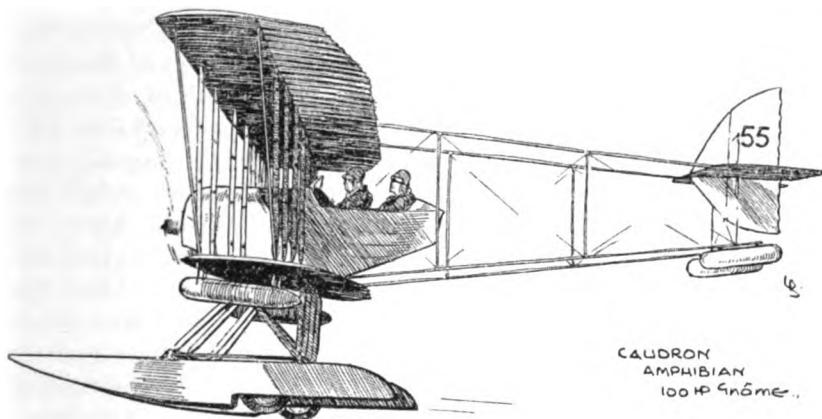
<sup>1</sup> It is thought that No. 81 deserves some notice, as she was a great advance on contemporary seaplanes. She had wings which could be folded, was fitted with a 160 b.h.p. Gnome engine, and carried a Rouzet wireless telegraphic apparatus.

respective commanders were informed later that a state of war existed as from 4.0 p.m. that day. The operations were watched by the First Lord of the Admiralty (Mr. Winston Churchill) from the Admiralty yacht, the *Enchantress*, and the gathering aboard her included Field Marshal Sir John French.

The chief feature of the operations of the first day (July 24) was that *Red* transports, largely aided by low visibility, succeeded in landing 2,500 troops and some guns from the transports *Plassey* and *Dongola* at Immingham. The supporting vessels also shelled the camp of the defending (*Blue*) troops. After having inflicted military 'damage' to Immingham Docks (Grimsby), the raiding troops returned to their transports and retired without being subjected to serious attack by the *Blue* forces. At about the same time that these troops were landed 2,000 more with guns were landed also at Grimsby from the transports *Rohilla* and *Rewa*. They overcame the resistance of the defending troops and captured the town, and then sent out parties to Goxhill and Newholland to capture the Humber ferry. During the attack (which took the *Blue* forces by surprise) the *Red* fleet kept watch on its lines of communication and successfully covered the retirement of the raiding forces. Intermittent and desultory fighting (largely hampered by thick fog) then took place between opposing vessels during the day. Early next morning (the 25th) *Blue* troops re-entered Grimsby.

In the early hours of the morning of the day of this raid (the 24th) the *Hermes* left Great Yarmouth Roads to proceed to a position to the northward of Spurn Point, where she anchored. In the early afternoon, although there was a considerable swell, she got under weigh and then hoisted out No. 81 (Short seaplane). The pilot of this machine was ordered to scout to the northward. Considering the heavy seas, the machine got off the water remarkably well and proceeded under orders to scout to the northward, but unfortunately, about half an hour afterwards, a dense fog came up and she was obliged to return. During the course of this brief reconnaissance, she was in touch with the *Hermes* by wireless telegraphy. On reaching her parent ship, despite the heavy swell, she was hoisted inboard without suffering damage. The *Hermes* then returned to Great Yarmouth and, having taken on board No. 55 Caudron seaplane (in place of the wrecked Borel monoplane No. 48, referred to previously), left for her former rendezvous in the afternoon of the next day (the 25th), but fog and sea prevented any flying.

On the day that 'war' was declared (July 23) the weather was too bad for any flying to be done by the machines at Great Yarmouth air station, but on the following day (the 24th) the weather had moderated and the pilot of No. 20 (Short seaplane, 100 b.h.p. Gnome engine) went off early in the morning, flew to the New Leman Bank, returning to the air station by the Haisborough light vessel. Owing to the heavy surf, great difficulty was experienced in beaching the machine after she had alighted, but the task was accomplished successfully later. As the sea was too bad to launch a seaplane again, No. 67, a land machine (Maurice



Farman, 70 b.h.p. Renault engine), flew off to make a reconnaissance up to Wells Harbour, and her pilot sighted two submarines off Cromer. As No. 67 was not equipped with wireless telegraphy apparatus, she could not report having seen these craft until her return, thus demonstrating the absolute necessity of wireless telegraphy in machines engaged in reconnaissance.

Turning now to the air stations under the *Blue* flag, there were at Cromarty three machines, namely:

No. 117. Maurice Farman seaplane, 120 b.h.p. Renault engine.

No. 85. Borel seaplane, 85 b.h.p. Gnome engine.

No. 59. Sopwith seaplane, 100 b.h.p. Anzani engine.

It was arranged that an aerial patrol was to be made from this station three times a day, 'at 9 a.m., 11.45 a.m., and 4.0 p.m., between Cromarty and Nairn, Lossiemouth, and Tarbet Ness, the distance being about 60 miles', and that all reports were to be made to the responsible naval centre on return, because none of the machines had any wireless telegraphic apparatus fitted.

The torpedo boat *No. 15* acted as a tender for duty with the seaplanes. For the first two days the patrols sighted none of the opposing craft.

At Leven there were also three seaplanes:

*No. 42*. Short seaplane, 80 b.h.p. Gnome engine.

*No. 71*. Maurice Farman seaplane, 70 b.h.p. Renault engine.

*No. 86*. Borel seaplane, 80 b.h.p. Gnome engine.

No flying was done on the first day of the manœuvres (on the 24th), but on the second day (the 25th) *No. 42* (Short seaplane) flew over the mouth of the Firth of Forth for 1 hour 34 minutes, but none of the opposing craft was sighted.

To revert to the main operations, on the morning of the 25th the commander-in-chief of the *Red* fleet decided to attempt a landing on the coast of Northumberland with the troops from his transports. In the evening these transports, with their supporting cruisers, were sighted by *Blue* cruisers, and an indecisive, long-range action was fought. The *Blue* cruisers drew off, apparently not having sighted the *Red* transports which, incidentally, had been putting up a funnel smoke screen. After this action the convoy was collected, and *Red* destroyers later made a night attack on the *Blue* cruisers, who claimed to have put the former out of action. During the night (25th-26th) the raiding convoy (*Red*) separated, because it was intended to land troops at two different points along the coast.

In the early hours of the next morning (the 26th) the *Red* transports were sighted by *Blue* coastguards, and later the transports were attacked by submarines. Troops were landed, however, at Blyth and Sunderland, there being isolated actions between the opposing naval supporting forces, with losses claimed on both sides. During the same day (the 26th) the transports and their supporting screen withdrew into their own territorial waters, and for the remainder of the day the heavy ships on both sides were engaged, during which *Red* was considered to have suffered severe losses. This action was followed by the *Blue* fleet chasing the *Red*. Later, the former were attacked by submarines, and the chase was abandoned subsequently.

On the 25th the pilot of *No. 84* (Borel seaplane) from Great Yarmouth air station sighted the two submarines that *No. 67* had seen the previous evening, and flew low enough to take their numbers, and on alighting reported their presence by telegram to Sheerness naval centre. Later in the same day the pilot of *No. 67*

(Maurice Farman land machine) flew along the coast to Sheringham and back, but saw nothing of the hostile fleet. In the afternoon, in thick weather, the pilot of No. 84 (Borel seaplane) flew over Cross Sands light vessel, thence on to the north of Smith's Knoll light vessel, and flew alongside one battleship and four destroyers. After (in the words of the report) 'some fine navigation' she alighted at the air station.

On the morning of the 26th (the day of the Blyth and Sunderland raid) the *Hermes* was unable, on account of the heavy sea, to launch No. 81 (Short seaplane), and could not do so until late in the afternoon. This machine had then some difficulty in leaving the water, and on one occasion, when alighting, bounced so heavily that her undercarriage was badly damaged, and she had to be hoisted inboard for repairs. The same day No. 67 (Maurice Farman land machine) made a patrol in the forenoon from Great Yarmouth air station, and her pilot observed two *Blue* submarines attacking a *Red* submarine depot ship. Owing to fog the machine had to return to the air station. Later in the afternoon No. 29 (Maurice Farman seaplane) flew for some three and a half hours over the Wash, but her pilot saw no craft. Later in the day No. 20 (Short seaplane) was compelled to alight at Winterton, and the pilot and observer were captured by *Blue* Territorials. Afterwards, great difficulty was experienced in beaching this machine on account of the heavy surf. One seaman did exceptionally good work in swimming out to her in a strong tide, at 10.30 p.m., with a rope, after the dinghy had been swamped. At Cromarty on the 26th the aerial patrol had sighted a *Red* submarine off Lossiemouth, which was subsequently put out of action by *Blue* torpedo boats. On the same day at Leven the pilot of No. 42 (Short seaplane) started a patrol off the Firth of Forth, but was forced to abandon it after half an hour on account of engine trouble.

The next morning (the 27th) was opened by another attempted raid by *Red* on Blyth. This raid was preceded by destroyer actions, in which *Red* destroyers were supposed to have been put out of action by *Blue* destroyers and submarines, which left the *Red* transports at the mercy of the *Blue* naval forces. At the time most of the heavy ships of both fleets were at their bases, coaling.

The first part of the manœuvres was concluded early that evening.

It should be mentioned that the *Red* fleet had also adhered to

the other part of the general scheme, namely, in harrying *Blue's* merchant shipping in the Atlantic. The general plan adopted by *Red* for such operations was to attack commerce during daylight, and during the night to make for some other part of the route—keeping away from the track of shipping—on which to operate during the following day. Despite the presence of *Blue* in these waters a squadron of *Red* battleships and cruisers (of a total strength of three vessels) 'captured' a large number of merchant vessels on the America, Fastnet, and Finistère route, much to the wrath of their captains, according to accounts of the time.

On the last day (the 27th) of the first phase of the operations the *Hermes* sent off No. 81 (Short seaplane) on a patrol. Her pilot sighted nothing of the *Blue* fleet, and despite the heavy sea alighted without damage. On the same day two valuable patrols were made by pilots from Great Yarmouth air station, the pilot of No. 84 (Borel seaplane) sighting, in heavy rain-squalls, a *Red* submarine. No patrols were made by the machines at Cromarty, but the Short seaplane from Leven stove in a float on alighting after a patrol in the neighbourhood of May Island, and had to be taken in tow by a torpedo boat.

For the next three days (the 27th–30th) both fleets were engaged in coaling and making the necessary repairs in readiness for the second phase of the manœuvres. In these further operations the strength of the fleets was somewhat modified by alterations in small craft, but the main fleets remained the same. There was no alteration in the disposition of aircraft.<sup>1</sup> The general idea behind these operations was that *Blue* had to endeavour to bring the *Red* fleet to decisive action at the earliest possible moment, or, failing this, drive him into his ports and establish a blockade, with the object of preventing a continuance of the raids on *Blue* territory and into the Atlantic. 'War' was declared on July 31.

The first day was spent in preliminary movements of the opposing fleets; during the night *Red* destroyers attacked *Blue* forces in the Humber. Considerable fighting took place there between opposing destroyers, with losses on both sides. In the early hours of the next morning *Red* raided Winterton. Later, *Red* broke through *Blue* cruisers, after some fighting. Another intended raid on Blyth by *Red* was abandoned on account of the strength of *Blue* in that area.

<sup>1</sup> It is interesting to note that on the 28th No. 55 (Caudron seaplane) was flown from the forecastle of the *Hermes* while she was steaming head to wind at a speed of 10 knots—with 'force of wind of 1 to 2'.

During the same day (the 31st) a cruiser action was fought, in which it was adjudged that some of the *Red* transports were sunk. In the late afternoon *Red* sighted the *Blue* battle fleet, and a general action was fought. After this 'Battle of the North Sea' (which was subsequently ruled 'a drawn fight') the manœuvres concluded. It should be mentioned that throughout the operations hazy atmospheric conditions prevailed, with low visibility as a consequence.

Owing to the damage previously done to the machines, comparatively little flying was done at Great Yarmouth air station during the second phase of the manœuvres. On August 1 the pilot of No. 67 (Maurice Farman land machine) saw two hostile submarines with their attendant destroyer, and later in the day the pilot of No. 20 (Short seaplane) sighted two other submarines. On the same day the *Hermes* sent out No. 81 (Short seaplane), and after making a flight of about 50 miles she started to return. Fourteen minutes afterwards the *Hermes* received an undecipherable wireless telegraphic message, and then—nothing more. It seemed probable that she had been compelled to alight, and the value of a sound system of wireless telegraphy in aircraft was then shown. From the messages received in the *Hermes* the probable position of the machine was determined. As a matter of fact, this position was within two miles of where she had come down.

Immediately the *Mermaid* was directed to search for her, and the *Hermes* proceeded to sea as soon as she had raised steam. On the way to the supposed position of No. 81 the *Mermaid* met a German merchant steamer, the *Clara Mennig*, with the seaplane and crew aboard. They had alighted close to this steamer, and had been picked up and treated by her crew with great consideration.

The seaplane had been compelled to alight because a piece of tin in the inside of the engine cowling had come adrift and had sheared four ignition wires—so stopping the engine. This accident only shows how absolutely essential it is to maintain a rigorous inspection of aircraft. Commander Samson was the pilot and Lieutenant Raymond Fitzmaurice the observer of the seaplane, and it is interesting to read the latter's account of their adventures, as this incident was the forerunner of many similar forced alightings:

'We started off from the *Hermes* at Yarmouth at 9 a.m. on a lovely day, making a good 75 miles an hour, at about three to four thousand feet up; sometimes we had to come down to within 500 feet to get clear of the

clouds and to get a good view. It is surprising how low clouds are; from below it may look as if the clouds are two or three thousand feet up, but on going up you often get into them at three or four hundred feet up. This is especially the case in the North Sea, and during the manœuvres there were few days that you could see anything at a greater height than six hundred feet.

'We went about sixty-five miles out and seeing nothing of the enemy, turned back.

'I had been sending signals by W/T all the time and had just reported a tramp on the starboard bow, when the engine suddenly stopped.

'We unfortunately made a bad landing and completely smashed our under-carriage and part of the lower plane and tail; fortunately, however, the tramp came to our rescue and hoisted us on her poop.

'She was a German timber boat, the *Clara Mennig*, bound from the White Sea to Tilbury; they were most kind and hospitable, but could not go out of their way to take us to Yarmouth.

'A few hours later the *Hermes* hove in sight, having realized from our stoppage of signals that something was wrong; we hoisted out again from the *Clara Mennig* and hoisted into the *Hermes*, having had a very interesting day.'

So ended the manœuvres, which were held in fog, driving rain, and, at times, heavy weather; but, despite this, aircraft came out of their trial with enhanced prestige. A good deal of experience was gained, and probably the most valuable lesson learnt was that it was absolutely necessary for aircraft to be fitted with wireless telegraphic apparatus, for without it the value of their services for reconnaissance work was very limited. It was also found that only the larger seaplanes were capable of standing up to rough sea work, and as a result of this experience it was considered that all floats should be sprung, and, as the experimental fitting of folding wings to the Short seaplane appeared to be satisfactory, it was felt that for ship-work this type of machine would have in the future considerable use. It was decided that the fitting out of the *Hermes* to carry seaplanes had justified itself, and that the experience gained would help materially in the development of an improved type of seaplane-carrier. Great Yarmouth air station distinguished itself during these manœuvres, because more patrols were made and more hours flown than by any other of the air stations. Moreover, the utility of land machines at the air station was shown because, by their aid, it was practicable to carry out aerial patrols when the conditions obtaining at the time prevented the launching of seaplanes. At the same time, it is proper to observe that this very fact constituted a sufficient proof that the air station was not a suitable seaplane base.

At the Cromarty air station some experiments on mooring were conducted with the Maurice Farman seaplane, with interesting results. This machine, which had 'sprung' floats, rode out well at her moorings, despite the bad weather, without incurring any damage.

A few days later, after the conclusion of the manœuvres, *The Times* newspaper published two letters from their military correspondent, who appended a letter to him from a German officer signing himself as 'Colonel Donner und Blitzen'. These letters analysed the lessons of the operations, and in one of them (August 27) said:

'I thought and still think that we have nine chances in ten of the initiative of a war with you, firstly, because all our problems by sea and land are made for the offensive; secondly, *weil Kriegsführung und Politik bei uns Hand in Hand gehen*'<sup>1</sup>; and thirdly, because you are constitutionally incapable of declaring war and striking the first blow.'

He followed this letter by one on September 8, in which he drew the following lessons from the manœuvres:

'It has been demonstrated that a British fleet superior to its enemy in the proportion of two to one cannot with certainty prevent the landing of considerable forces on your shores; cannot keep under constant observation a hostile fleet; is not safe from torpedo attack in the exposed anchorages and insecure bases of your east coast; cannot trust to a defensive deployment of flotillas *en cordon*; is insufficiently supported by badly armed works and ports without submarine mines; is liable to see its exposed oil-tanks, wireless stations and magazines destroyed by raiders; is at present without adequate aerial defence; cannot make sure of sinking hostile transports by the action of submarines owing to the inferior range of vision and slow speed of the under-water craft, and finally, cannot completely protect your trade routes even in home waters. It can and it has caused the enemy loss in ships and men, but it has not, by the strategy and tactics employed, prevented the enemy from carrying out his mission of raiding your warships in exposed anchorages, of landing troops upon your shores, and of preying upon your trade.'

While he did not

'decry the Navy in any way, nor suggest that anything can be a substitute for naval force, I merely repeat what I have frequently stated before—namely, that the protection afforded by your navy is not absolute but only relative.'

A year or two later the truth of the majority of these statements was substantiated.

<sup>1</sup> 'Because with us military science and politics go hand in hand.'

### III

#### THE GROWTH OF GREAT YARMOUTH AIR STATION

THE importance of sound design in a float seaplane was becoming realized, for at first many had thought the subject presented no particular difficulties. The state of affairs, the problems and the difficulties to be surmounted were enumerated by a writer in *The Times* newspaper, when describing the seaplane contest held at Monaco in March (1913):

'It is abundantly clear that the best water-planes at present produced have not been designed with a real recognition of the special problems confronting this type of aircraft, but are merely successful aeroplanes more or less adequately erected on floats. The difficulty of combining speed with the ability to carry sufficient fuel for a flight of 300 miles is shown by the fact that of the 16 machines with magnificent pilots entered only seven accomplished their preliminary trials, and nine have been more or less seriously smashed. The constructors now realize that they must entirely alter many of their preconceived ideas. The difficult conditions which have prevailed here will thus promote progress, for if wind and sea had been more propitious the constructors might have been encouraged by easy prize-winning to continue making machines which have now been shown to be incapable of fulfilling the requirement of sea-service. . . .

'The problem is extremely difficult and interesting. To lift from the water a machine carrying sufficient weight of fuel for a useful flight necessitates a big engine, and this in turn means greater weight. Then, when the rising has been successfully accomplished, there come the questions of alighting and navigating a choppy sea. The number of machines which have broken their fuselage—to say nothing of their wings, which crumple up at the slightest contact with the sea—shows that far greater strength of construction is necessary; as for the question of floats, it is quite clear that the whole problem requires to be approached afresh with the aid of boat-builders' experience. The strains and shocks to which water-planes are liable prove to be far greater than the designers were prepared for. . . .

'What the meeting has conclusively proved is that popular generalizations about the capabilities of water-planes now or in the near future are even more hazardous than most generalizations connected with aeronautics.'<sup>1</sup>

The state of affairs in the matter of seaplane design in the summer of 1913 was not lost sight of by the Admiralty Air Department and, with the experience gained at the naval manoeuvres, improved types of machines were issued to the Service during the year.

<sup>1</sup> *The Times*, April 14, 1913.

One of the lessons learnt at Great Yarmouth air station from the naval manœuvres was that it would be necessary to make a concrete bed in front of the sheds, with a firm surface, thus replacing the loose sand. Into this sand the seaplane trolley wheels sank axle deep, and consequently, to move the machines, more men were needed than the station could spare.

In the middle of August (1913) certain instructions were drawn up for the conduct of naval air stations which, in general, laid down that 'all matters concerning routine, organization, discipline, &c., are to be conducted as far as possible according to the usual naval regulations and customs'. Inasmuch as the work to be done by the coastal air stations was largely experimental, it was stated also that officers were to be encouraged to furnish reports on subjects, for example, as:

1. The possibility of establishing a permanent air station in a site more suitable for the purpose other than the one already occupied.
2. The suitability of the aircraft supplied for naval purposes, with suggestions for its improvement.
3. The local weather phenomena and kindred matters.
4. Suggestions for the improvement of the efficiency of air stations.

In addition to the above it was stated that information and proposals were needed with respect to:

1. Designs for seaplane floats.
2. Anchors, instruments, and other accessories to be carried in aircraft.
3. Armament for aircraft and its use.
4. Reconnoitring by aircraft.
5. Navigation in aircraft over the sea.
6. The handling of aircraft on water, and the best type of boats, launchings, and transporting trolleys for the purpose.
7. Communication with and between aircraft.
8. Aircraft recognition signals.

In short, it was impressed upon all ranks that the future growth of the Service depended upon the technical development of its instruments (using the term in its broadest sense), and this development was dependent upon the keenness shown in research on the part of those who handled these instruments.

At the same time (August) that these instructions were promulgated the grouping of the coastal air stations was announced.

In the Great Yarmouth area Newcastle was to be the principal air station, with Cleethorpes and Great Yarmouth as sub-commands. Actually, an air station was never commissioned at Cleethorpes, but at Killingholme, a place situated a few miles up from the mouth of the Humber, near to the Admiralty Oil Depot at Immingham.

On September 2 it was decided that all ranks and ratings of the Naval Wing should be transferred to the books of the *Hermes*, with the exception of those officers and men on the staff of the Central Flying School, who were borne on the books of the *President*.

Autumn was now approaching and, owing to the local conditions, the matter of whether or not Great Yarmouth air station should be kept fully manned during the winter months or handed over to a 'care and maintenance party' was raised. Lieutenant Commander Gregory opposed the latter course, for, he said, it would 'take at least six months before the station can properly settle down and become really efficient'. He suggested that it should be kept in full commission during the winter months, and on the days when no flying was possible both officers and ratings should attend courses of instruction. He added that he thought that 'ratings ought to remain at their stations for two years without changing'. This opinion proved sound, for it was subsequently found—as might have been expected—that the constant change of personnel had a markedly adverse effect on the efficiency of a station or squadron.

Owing to the difficulties experienced in bad weather in launching seaplanes from the air station, it was decided to make a survey of all the Broads in Norfolk, to see if any of these waters could be made use of as the 'place' of an air station, both for seaplanes and land machines, because it was found that the conditions at Great Yarmouth air station seriously militated against flying, especially in the autumn. The duty was delegated to an officer of the air station, a marine, Captain H. Fawcett, R.M.L.I. He made a most careful survey of the district, and in due course reported that Hickling Broad appeared to be the most suitable. This Broad is some four miles from the sea and lies in a north-westerly direction about 12 miles in a direct line from the South Denes. This large sheet of water joins the Horsey Mere, and possesses many of the natural advantages desirable in a seaplane base, with the drawback, however, that the water is shallow, and during the summer months rather weed-grown. Owing to finan-

cial and other difficulties the proposal to employ this water was dropped, although, towards the end of the War (August 1918), it was used occasionally by flying-boats. It was thought by pilots that, had this Broad been used as the place of an air station, it would have proved of value during the War, for then it would have been possible to send away seaplanes and flying-boats on patrol, when frequently conditions at Great Yarmouth precluded this step.

Another plan to overcome this difficulty, proposed at the air station towards the end of 1913, was to pour oil on the surf. Some experiments were made which extended until May of the following year. The results obtained showed that in order to produce an appreciable effect in deadening the action of breaking surf, large quantities of oil would have to be used, which would involve the Service in heavy expense, and, moreover, the oil would seriously pollute the water—so the proposal was abandoned.

Towards the end of October (on the 26th) the First Lord of the Admiralty (Mr. Winston Churchill), in a Minute,<sup>1</sup> gave an outline of the progress made by the Naval Wing up to that time. It was stated in this Minute that the development of a standard type of seaplane, suitable for war purposes, was proceeding rapidly, and furthermore it was stated what were considered to be the tactical duties of naval aeroplanes and seaplanes. These duties in no wise departed from those that had been previously laid down. The First Lord also recommended three new types of machines: firstly, an oversea fighting seaplane to operate from a ship as a base, secondly a scouting seaplane to work with the fleet at sea, and lastly a home-service, fighting aeroplane to repel enemy aircraft attacking vulnerable points of Great Britain, and to perform patrol duties along its coast. This Minute was also concerned 'with the Zeppelin, which should be attacked . . . by an aeroplane descending on it obliquely from above, and discharging a series of bombs or fireballs, at rapid intervals, so that a string of them, more than a hundred yards in length, would be drawn like a whip-lash across the gas-bag'.<sup>2</sup> It will be understood from the proposals thus made that the policy which should govern employment of naval aircraft was understood and defined.

Arising out of this Minute, 25 of the 'oversea fighting', 15 of the 'home-service', and 20 of the 'sea scouting seaplanes' were ordered by the Admiralty.

<sup>1</sup> Vide *The War in the Air*, vol. i, pp. 265-6.

<sup>2</sup> *The War in the Air*, vol. i, p. 266.

## 62 THE GROWTH OF GREAT YARMOUTH AIR STATION

In November it was proposed to station a military aeroplane squadron in the neighbourhood of Great Yarmouth. With this object in view, Captain R. Pigot, of No. 1 Squadron, R.F.C., was detailed 'to reconnoitre the neighbourhood of Yarmouth and report on its suitability for a Station of an Aeroplane Squadron of the Royal Flying Corps (M.W.)'. Owing to the difficulties in the way of obtaining a suitable site, the proposal was abandoned, although, during the War, some military air stations were formed within a few miles of the town.

In the same month a scheme was put forward which proposed the recruitment of men from civilian life for duties at air stations. It was suggested that the men so recruited should be divided into two classes: firstly, men for the care, maintenance, and repair of machines; and secondly, men for duties as, for example, chauffeurs, storekeepers, servants, and telephone operators. The number required for the first category was approximately 12 men to a flight of 4 machines. On that basis it was claimed that 20 men would be required at Great Yarmouth air station.

At the beginning of December it was announced that the headquarters of the Naval Wing would be transferred from the *Hermes* to the Naval Depot at Sheerness. The ship was paid off, but continued her duties as a seaplane-carrier. At the end of this month the post of Inspecting Captain of Aircraft was created, and Captain F. R. Scarlett, R.N., late second-in-command of the *Hermes*, was appointed. This officer was in general charge of all naval air stations, under instructions from the Admiralty Air Department. He was responsible (to the Department) for all aircraft being, as far as practicable, in a state of readiness for use, and to the commander-in-chief of the Home Fleets for all matters in connexion with aircraft in ships afloat.

It may be remembered that when it was proposed to form the chain of air stations on the east coast, it was suggested that the personnel therein borne should take over, eventually, the duties performed by the Coastguard Service. After negotiations with the responsible departments, it was announced (in the autumn of 1913) that the air station at Great Yarmouth, together with those at Calshot and Isle of Grain, should take over these duties ('Customs', 'Life-saving', 'Coast Intelligence', and 'Meteorology') at the end of the year. Certain naval ratings at the air station were furnished with warrants as deputy Customs officers, in order to enable them, when necessary, to board merchant vessels. That these new tasks were not without adventure may be gathered from

THE GROWTH OF GREAT YARMOUTH AIR STATION 63  
the following account, written by one of the naval ratings concerned:

'The watchroom was manned day and night, two men in a watch, each watch being of six hours' duration. Patrols to the south along the beach and meetings to the north with a man from the next station (Caister) had to be carried out nightly, one in each part of the night. Dispatches for stations north in the Coast Guard Command were always taken by hand, and I once remember one of the men with a large load who had been training on beer for the occasion, fell into the sea with his load, and we had to send out a patrol to find him.'

'The various duties were as follows: Signalling to H.M. Ships and merchant vessels, reporting wrecks, take charge of and report salved wreckage, meet all boats landing, search at least four vessels a month in the harbour for contraband, assist in lifeboat launching and complete crew if necessary, take charge of and carry out drills with Board of Trade life-saving apparatus, and numerous other little items that fall to the lot of the Coastguardsman. The vessel searching was rather farcical, but it had its amusing side. Often nobody in the crew could speak English, but we got our particulars somehow.'

The transfer was a boon to Great Yarmouth air station, for the building hitherto used and occupied as living-quarters by the coastguards was handed over to the personnel of the air station. This building was known as the 'Coast Defence Station'—or, shortly, as the 'C.D.S.'—and was occupied by officers and men of the Naval Wing from January 6, 1914, until the air station was closed down after the War.

With the close of this eventful year, it will be seen that there was justification for the official statement that, during the year 1913, 'the organization of the Naval Wing has proceeded satisfactorily'. Five seaplane stations were in commission, and a steadily increasing number of officers and men was being passed into the Service and the number of available machines and airships was growing. The record of miles flown during the year by naval aeroplanes and seaplanes was no less than 131,081.

Space forbids an account of the great amount of experimental work done, which ranged over wide fields, including night-flying (particularly by Commander Samson), visual signalling, wireless telegraphy, armament, torpedo-carrying aircraft, engines, meteorological work, and seaplane floats. With regard to the latter, it was stated that:

'The progress in design of the seaplane itself is satisfactory and certain specific types are being developed. Machines have been specially constructed with folding wings, and sprung floats are being almost universally adopted. The general tendency in the design of floats is towards a boat

shape. So far the twin-float seaplane has shown itself to be the most secure. Some types of three-float machines, that is to say, machines with a central float and two large wing floats, have proved satisfactory abroad, and this class of machine will be exhaustively tested by the Naval Wing in the near future. A development of the boat type on these lines is also being experimented with.<sup>1</sup>

In view of its importance, it is felt that the experimental work in connexion with aircraft armament deserves some mention. It may be stated that Lieutenant R. H. Clark-Hall, R.N., had been placed in charge of this work—as from July 29, 1913. At the end of the year (1913) three semi-automatic guns had been ordered and distributed for trial purposes, the Navy and the Army having agreed to participate in this work. The first of these guns was a 1½-pdr. Vickers, which it was proposed to mount in the *Astra Torres* airship and later in a seaplane (No. 93). The second was a 1-pdr. Elswick, with which trials were to be made in a 'gun-carrying aeroplane'. The third one, a 1-pdr. Coventry Ordnance gun, was to be sent to the Royal Aircraft Factory 'for trial from a specially built machine'. Experiments had been previously conducted with this particular gun in a F.E.3 machine (i.e. 'Farman Experimental' No. 3—a product of the Royal Aircraft Factory), 'when suspended off the ground by ropes' from a gantry. Two valuable lessons had been learnt from these trials: firstly, 'that without doubt, the discharge of the gun will have no appreciable effect on the stability of the machine'; and secondly, that 'the semi-automatic gun is not suitable for the work, but that an automatic gun is necessary'. It was also believed that it would, in the future, be found necessary to adopt some form of shoot 'to lead the empties clear of the propeller'—a belief since justified. In view of these conclusions it was decided to fit some machine-guns in an aeroplane and to conduct a series of trials in the air. These trials, however, were not started till early in the following year.

Experiments with bombs and bomb-throwing gear were started in 1912, dummy bombs being used in these tests. The bombs were modelled on, and were equal in weight to, the 100-lb. and 10-lb. bombs which were then being manufactured at the Royal Arsenal, Woolwich. The targets used were made of old torpedonetts spread over a wooden framework raised from the ground. Experiments were also made in 1913 with 'Hale' rifle grenades,

<sup>1</sup> Memorandum on Naval and Military Aviation (Cd. 6695).

with a view to determining their effect against airships, and whether their fuses were delicate enough to detonate upon impact with these fabrics. All these experiments were hampered by the lack of suitable machines and a sufficient number of live bombs. At the end of the year (1913) a trial was made for determining the effect upon the stability of a machine in flight when a bomb was dropped and exploded beneath it. It was found, generally speaking, that stability was not affected if the explosion occurred more than 350 feet beneath the machine. A bomb of 100-lb. weight was used in these trials. In addition to this research considerable progress was made with the anti-aircraft armament of ships and with the protection of magazines and other vulnerable points. In short, the work of the Naval Wing at the end of 1913 was purely instructional and experimental, for it could not be said that the Wing was ready to assume its intended role in the scheme of local defence.

At the end of the year Great Yarmouth air station had on the ship's books 7 commissioned officers, 2 warrant officers, 29 ratings, and 3 pensioners. The officers were: Squadron Commanders R. Gregory, C. L. Courtney, Flight Commander H. Fawcett, Flight Lieutenants R. J. Bone, W. G. Sitwell, C. E. Maude, and Sub-Lieutenant R. H. Kershaw. The two warrant officers were a boatswain (G), H. C. Bobbett, and a carpenter, L. R. Staddon.

There were 3 machines on the station: *No. 20* (Short seaplane), *No. 29* (Maurice Farman seaplane), and *No. 69* (Maurice Farman land machine). The latter was, it may be remembered, the first machine to arrive at the air station, and, in the words of one of the ratings, 'was in most general use, a joy-ride 'bus in the real sense. *No. 20* occasionally flew, but *No. 29* hardly ever. To start *No. 20* up was a feat of strength and was rarely accomplished in a short time.'

## IV

### THE EVENTS AT GREAT YARMOUTH AIR STATION FROM JANUARY TO AUGUST 1914

THE opening weeks of the year 1914 saw the addition of new machines to Great Yarmouth air station which was badly needed. These machines were Henri Farman seaplanes, equipped with either 120 or 80 b.h.p. Gnome engines and 'Deauville' type floats. They were erected by French mechanics and were tested by a Belgian pilot—a Monsieur Fischer—and on one occasion by Monsieur Henri Farman. A considerable amount of flying was done with these seaplanes, and, in the opinion of pilots, 'both types were nice to fly, but of course the bigger one was the better. On one occasion one of these flew down to Calshot in half a gale.' Further experience with them, however, showed that 'they were inherently poor seacraft', and they did not survive long after the outbreak of the War. Additional officers and ratings were drafted to the air station, and this increase in personnel enabled more flying to be done. The officers arriving early in the year were Lieutenants R. J. Bone, W. G. Sitwell, H. A. Williamson, R.N. (the name of the latter may be remembered in connexion with a paper that he had submitted two years before—January 2, 1912—suggesting the use of aircraft for the detection of submarines), and Sub-Lieutenant R. H. Kershaw, R.N.R., who was posted from Calshot air station.

As early as January (1914) some progress was made with the work of fitting machines of the Naval Wing with apparatus for wireless telegraphy. It has been stated that at the time mentioned, gear for telegraphy was fitted in 9 seaplanes, and that it was to be installed in 4 more. There were, however, 24 which were without this equipment.

One of the most important events connected with the Naval Wing at this time was the trials conducted with a Vickers machine-gun firing from an aeroplane, trials, it may be remembered, which were foreshadowed in the previous year. In January (1914), however, systematic experiments were begun. The firing was mainly at heights of 500–1,000 feet, using as targets small objects dropped into the sea, satisfactory results being achieved. Experiments were also undertaken against small free balloons,



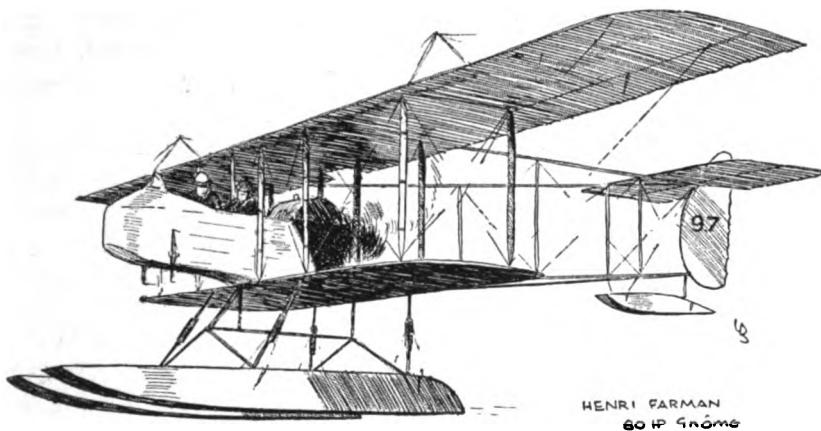
The first machine to arrive at Great Yarmouth air station—  
*No. 69 Maurice Farman 'Longhorn'.*



*No. 20 Short Seaplane equipped with the G.R.W. gear.*

1870-1871  
1871-1872

which were attacked in the following manner: 'a kite was sent up to a height of about 500 feet, to the string of which were attached, as targets, two small rubber balloons of about 12 inches diameter . . . all the firings were carried out whilst either passing or approaching the target at a speed of 50 miles per hour'. The results obtained from this series of trials were of value. Lieutenant Clark-Hall (the Armament Officer of the Naval Wing) was of the opinion at the time that, amongst other things, 'the function of the machine-gun is not the attack of objects afloat or



ashore, but of other aeroplanes'. This was the view held for several years, until modified partially by the advent of 'ground-strafing' by low-flying machines. It must be said, however, that this form of offensive action depends more upon its moral than material effect, for 'unless some form of shrapnel bullet be used, the area swept by the machine-gun bullets must, of necessity, be extremely limited'.

He also said that 'machine-gun aeroplanes are (or will be) required to drive off enemy aeroplanes approaching our ports with the intention of obtaining information or attacking with bombs our magazines, oil tanks, or dockyards'.

As a result of these trials he made suggestions for a 'gun-carrying machine'; that 'it is very essential for it to have a greater speed than its opponent. It should also have good climbing power to enable it to get up to the attack quickly.' He was then of the opinion that 'pusher machines' were superior to 'tractor machines' for the work, but he also stated that because 'superior speed is so essential, that if the tractor type continues in the future, as to-day,

to have very considerable advantage over the pusher in this respect, it may be necessary to sacrifice "mounting efficiency" for speed'. The tractor type machine regained its supremacy for fighting purposes some two years later, when the 'synchronizing gear', enabling a machine-gun to fire through the tractor air-screw, was introduced. No machines at Great Yarmouth air station were fitted at this time (January 1914) with a machine-gun, and it was not until some months later that one was so equipped.

It was in January (on the 1st) that, following a decision of the previous September, the Army Airship branch was disbanded, and the airships, together with certain of the personnel, were transferred to the Naval Wing. The airships were four in number, by name, *Beta*, *Gamma*, *Delta*, and *Eta*.

During February the suggestion was made that, owing to the continual trouble experienced with the trolleys used for launching seaplanes at Great Yarmouth air station, the method be abandoned, and that a slipway into the sea, similar to that in use at Calshot air station which had proved very successful, be constructed. Incidentally, the naïve observation made at the time of this proposal that 'of course the sea in Southampton Water is hardly ever more than choppy' may cause some pilots, with memories of Calshot, some amusement. The proposals for the slipway were prepared by Sub-Lieutenant Kershaw and, in the report which contained his suggestions, he stated that:

'the necessity for a marked improvement in the present method of launching a seaplane is very apparent. Trolleys for running a machine to the water's edge have so far proved themselves unsuccessful, as they either foul the departing seaplane, or need too many hands to manœuvre them. Surf, too, is a big enemy to the ordinary trolley, for, should the main floats succeed in taking the water without damage, it is highly probable that the next wave will lift them so high that the tail float will be dashed to pieces on the shingle.'

The substitution of a slipway for trolleys does not, however, get rid of all the troubles, as a trolley must still be used. The advantage of a slipway, provided it extends far enough out to sea, lies in the fact that a machine can be launched into deeper, and generally speaking smoother, water than is possible with a beach trolley. Neither of these methods is ideal in unsheltered waters, and it was to avoid these difficulties that float machines and flying-boats (especially the latter) capable of riding out bad weather at moorings were designed subsequently.

Observing the difficulties, some of the officers at Great Yarmouth air station devoted attention to the development of an amphibian type of machine. Some suggestions originated with Lieutenant Commander R. Gregory and Engineer-Lieutenant E. W. Riley (of the *Hermes*), and Mr. White, a Chatham Dock-yard official. Broadly, the proposals envisaged were for a 'wheel attachment to the floats of sea- and waterplanes to enable them to be used as land machines and to automatically eject the attachment when not required, such as rising from water, and also to abolish the use of trolleys in launching and landing sea- and waterplanes'. In its application, the invention meant fitting wheels with pneumatic tyres to the sides of the main floats of a machine, it being possible to release the wheels, when the machine was either afloat or flying, if so desired. A 'sprung disk wheel' was affixed to the tail float. The whole device was known as the 'G.R.W. Wheel Float Attachment', after the initial letter of the surnames of the three inventors, Gregory, Riley, White. Permission was given by the Admiralty to fit the device to *No. 20* (Short seaplane), and a series of trials with the attachment was made at the air station in the early part of the year. The trials were witnessed by Sub-Lieutenant Kershaw, and of one of them he wrote:

'The engine was started and the machine taxied along the concrete and turned down on to the slipway. She seemed to steer very well with the tail. Lieutenant Commander Gregory went down the slipway at a fair speed and straight on over about 10 yards of shingle into the water. Although travelling at a very fair speed (probably between 20 and 30 miles an hour) when leaving the slipway and striking soft sand the machine did not seem to have any tendency to get her nose down. Just before taking the water it appeared as if the machine were actually flying for about 2 feet. She took the water very easily and the wheels were then released as before. When Lieutenant Commander Gregory returned, the machine was turned round so that her tail was on the beach, and there being little or no surf, the wheels were attached without difficulty. He then took the seaplane out to sea a little way and turned her round and charged straight at the beach. Just at the water's edge the beach had formed a ledge and the wheels striking this caused the tail to lift uncomfortably high—at one moment it almost looked as if she would turn over on her nose—but it came down all right, and the pilot ran straight up the slipway to his shed under his own power.'

During another trial Lieutenant Commander Gregory 'charged the surf with the engine full out, double surf waves being 6 feet in height'. The passenger on all these trials was Engine-Room Artificer H. Hackney, R.N. Further experiments were ordered with this device, but at the outbreak of war they were abandoned.

Approval was granted to build a slipway at Great Yarmouth, but the construction did not remove all the troubles, for, as one officer said subsequently:

'This slipway gave us constant trouble; it was constructed of heavy sleepers which were pinned to piles driven into the beach. But though the levels might be correct to begin with, an easterly gale would entirely alter the conformation of the beach and some sections of the slipway would be perched up on "stilts", so to speak, where the shingle had been washed away from beneath them.'

During the life of the station this trouble was experienced with both the slipways. It was impossible to prevent these changes in level by the use of protecting groynes, as these would have rendered difficult the movement and handling of machines when afloat.

Some idea of the conditions holding in the Naval Wing at this time, and of the versatility of its personnel, may be gathered from the following account that was written by a rating who was then serving at the air station:

'In March, Mr. Bone, flying a Maurice Farman "Longhorn", came down in a field near Saxmundham, tearing off his tail plane and elevators on a tree-stump. Four of us were dispatched in a Crossley tender with lengths of spruce to effect repairs. Passing through Resingland village at top speed, we knocked down an old man carrying a cross-cut saw, veered round and demolished a blacksmith's shop, bending the front axle and rendering the tender useless. The old man was picked up, taken home, well soaked in brandy, and put to bed, while one of the party phoned for assistance. Mr. Courtney arrived in a cloud of dust with his racing car, and ordered us to transfer the tools and material to his car. That meant five of us in a two-seater racer with a smooth body. We had two punctures before reaching Saxmundham—adding to Mr. Courtney's amiability. Luckily the timber was broken off *exactly* the required length in the smithy crash, which eased tempers considerably, and with the help of a few tree branches, and of a nice farm wench who machined the fabric for us, we completed the job. Mr. Bone took off in a ploughed field with about a 50-yard run and sailed between two trees with wing-tips almost touching. After experiencing three more punctures, we arrived at Yarmouth, having changed our car again for a private conveyance. We always thought that Mr. Bone had the laugh on us on that trip, but that take-off of his was worth going a long way to see.'

In March—on the 17th—the First Lord of the Admiralty (Mr. Winston Churchill), in the course of a statement in the House of Commons, remarked that the Naval Wing had '103 aeroplanes, including 5 that have not passed through their trials, of which 62 are seaplanes, and we have 120 regular pilots and 20 officers

who have taken their Aero Club Certificate in aviation . . . we have 125 officers and 500 men in the Air Service and by the end of the year the numbers may reach 180 officers and 1,400 or 1,500 men'.<sup>1</sup>

At the end of April Lieutenant Commander Gregory reported that Colonel Lucas, C.B., M.V.O., who lived at Hobland Hall, just outside Great Yarmouth, had offered to lend a Lewis machine-gun to the Service for use in the aeroplanes at the station. In due course his offer was accepted, and the gun was mounted in a machine. During the course of the correspondence on the subject, Lieutenant R. H. Clark-Hall, R.N., mentioned that 'a Lewis gun is now under trial at Whale Island, after which I have arranged for its loan for trials from No. 66 at Eastchurch and gun-carrying seaplanes at Calshot'. At this period this officer had stated his views on the then most suitable form of armament for aircraft, remarking that:

'in my opinion, the most suitable form of "hand gun" for use in aeroplanes is the ordinary short Lee-Metford rifle—provided with grenades against airships and ball cartridge for use against other aeroplanes. To use the grenade successfully, it should be fired more or less vertically downwards. In most tractor machines the flooring of the nacelle could be cut away to allow this to be done equally well, either from the front or rear seats. For firing ball cartridge against other aeroplanes the best method would probably be to get above the enemy and fire down on to him; but in addition a certain restricted arc could be obtained by firing over the sides of the nacelle and for this the rear seat would be preferable to the front seat. The rear seat has, therefore, a slight advantage over the front seat as the position for the gunner; not sufficient, however, to warrant alteration in the usual design unless, as is intimated, there are also other advantages.'

'I would suggest that the time is now ripe to include in the specifications of all machines ordered the clause: "a hole to be cut in floor of nacelle to enable a gun or rifle to be conveniently fired by the passenger within the angular limits allowed by landing, chassis, &c., this hole to be covered by an easily removable hinged or sliding door".'

For a considerable time after the commencement of the War, pilots in the Royal Naval Service and Royal Flying Corps went out on aerial patrol armed only with a shot-gun or rifle.

In April a series of air operations was conducted (under Commander Samson) with the object of testing the defences of the Nore. The principal lessons learnt from these operations (which were of value to all naval air stations) were, in the words of Com-

<sup>1</sup> The Parliamentary Debates, 59 H.C. Deb. 58, p. 1911.

mander Samson, that 'defending aeroplanes should not be lured from their posts by the attacker'; that 'an observer should be carried in each aeroplane that is on patrol'; that 'efficient observers were needed on the ground to communicate with the defending machines'; that 'station keeping with two or three aeroplanes in company 25 yards apart is quite practicable with practice and first-class pilots'. The lessons learnt from the attacks were that 'at least 5 aeroplanes were needed at each defended point; that the attacker should endeavour to attack with the sun or against a dark background, and that his machine should not be painted white'.

A month before these operations were held Mr. Winston Churchill made a statement (March 17) in the House of Commons dealing with the functions of seaplanes and aeroplanes in the Naval Wing. During the course of his speech he made some observations which are of particular interest when reviewing the lessons learnt from the afore-mentioned exercises, for he said: 'Passive defence against aircraft is perfectly hopeless and endless. You would have to roof in the world to be quite sure . . . the only real security upon which sound military principles will rely is that you should be master of your own air.'<sup>1</sup> Subsequently, the truth of these words was confirmed strongly.

The weather in May was good at Great Yarmouth, and a considerable amount of flying was done at the air station. Two new 'permanent sheds' were finished (known as 'B' and 'C'), and several Farman seaplanes were delivered to the station. These machines, which were fitted with sprung floats and 100 b.h.p. Gnome engines, could carry fuel for 5 hours' flying. Wireless telegraphic apparatus was installed, and the fuselage was arranged for a machine-gun. The speed of these machines with full load was 67 miles an hour, and they could, under good conditions, climb to 3,280 feet in 12 minutes.

Some idea of the work done at this period at the air station may be gathered from the following notes abstracted from the current issues of an aeronautical journal:<sup>2</sup>

'May 12th, 1914. Lieutenant R. J. Bone made an early morning flight on Maurice Farman No. 29, flying over nine submarines and destroyers as they left the Yarmouth Roads. On the 15th he flew the same machine with Air Mechanic McArton to Heathersett near Norwich to see Hucks loop. The journey only took 15 minutes there and 20 minutes back. Lieutenant

<sup>1</sup> The Parliamentary Debates, 59 H.C. Deb. 55, pp. 1912-13.

<sup>2</sup> *The Aeroplane*.

R. J. Bone, R.N., made two flights on Short No. 20 and Sub-Lieutenant Kershaw, R.N.R., with Engine-Room Artificer Stroud, made a flight in Maurice Farman No. 69.

'On Tuesday Lieutenant R. J. Bone made three flights in Short No. 20 with Engine-Room Artificer Edwards and Chief Engine-Room Artificer Hackney and another as passengers. M. Fischer made test flights on new Henri Farman seaplane No. 120, Captain Fawcett, R.M.L.I., acting as passenger observer, and Sub-Lieutenant Kershaw (Maurice Farman No. 69) and Lieutenant Sitwell, R.N., also flew.

'On Wednesday Lieutenant R. J. Bone on Short No. 20 and Lieutenant Kershaw on Maurice Farman No. 69 with Lieutenant Sitwell as passenger, flew in the morning, and in the afternoon the same two pilots and Captain Fawcett flew, with passengers. On Thursday morning Maurice Farman No. 69 did much hard work, flying under the control of Captain Fawcett and Lieutenants Sitwell, Kershaw, and Bone successively, Lieutenant Bone taking Mr. G. W. Stone, the station photographer, as passenger for 10 minutes.

'On Friday Maurice Farman No. 69 was piloted in the morning by Lieutenants Bone and Kershaw, and by Captain Fawcett and Lieutenants Sitwell and Kershaw in the afternoon. Wireless tests were made on new Henri Farman No. 142 (100 b.h.p.), M. Fischer piloting with Wireless Operator Hendry as passenger. Later M. Fischer took Lieutenant Bone as passenger. Thereafter, Lieutenant Bone took this machine to Felixstowe with Wireless Operator Hendry as passenger, returning in the dusk at 8 p.m.'

During this month (May) a report dealing with the progress of the Royal Flying Corps was published which stated 'that the good progress in every branch of aeronautical work . . . has been steadily maintained'. It said that on May 1, 16 officers and 93 ratings had been trained at the Naval Flying School at Eastchurch, and at the Central Flying School 28 and 50 respectively, for naval duties. Including the men employed in the Naval Airship section, the total numbers employed in the Naval Air Service were 111 officers (including warrant officers) and 544 men (all ratings). No less than 186,437 miles had been flown by machines from the Central Flying School during the year that had elapsed since the issue of the previous report, making a total of 243,099 miles flown since the School opened in August 1912. The average number of hours spent in the air by pupils had increased, for at the commencement of 1913 it was 18 hours, and at the end 23 hours 23 minutes.

The Naval Wing had in its possession 95 machines—55 seaplanes, 35 biplanes, and 5 monoplanes. There were 49 machines

on order. During the year (between reports) the seaplanes had flown 51,052 miles and the land machines 62,026 miles. Airships and free balloons had also done good work, the former having flown 5,275 miles without any casualty, and the latter 12,848 miles—largely for training purposes.

Valuable work had also been done in meteorology, 'especially with regard to the air currents at various levels'. A considerable amount of research work on a variety of subjects was in progress at the Royal Aircraft Factory at Farnborough. Of the many experiments which had been conducted, the following were of importance: the design of a fighting machine, of a stable aeroplane, air brakes in order to check the speed of a machine on landing, gun mountings, 'designs for an undercarriage to withstand a heavy landing . . . for at present a landing gear breaks up when the aeroplane is dropped 18 inches on to a hard, flat floor, on all aeroplanes made, as far as submitted to the Royal Aircraft Factory'. This Factory had also started to build an experimental engine for aircraft. The report also stated that 'with the object of carrying a substantial weight of wireless, armour, bombs, signalling devices and spares a larger type of aeroplane has been studied and is progressing. The design admits of carrying 6 hours' fuel at 83 miles per hour and 180 lb., in addition to passenger and flyer. In the construction of this an alloy steel tube of exceptional properties was made at the instigation of the Royal Aircraft Factory.' The danger of fire in the air was realized, and 'accordingly, aeroplanes are being made with the whole of the structural work about flyer and passenger, as well as tails and engines, of steel, with aluminium sheets instead of fabric under these parts'.

The troubles associated with wooden propellers and airscrews 'which are fragile, which twist and warp and lose part of their efficiency, and which become unsafe with the exposure of their glued and dowelled parts to much rain', had led to experiments 'in favour of steel' although it was realized that it was heavy; the report was able to state that 'B.E. 2 is now flying with an all-metal tractor airscrew of aluminium and steel, though the latter metal is preferred'.<sup>1</sup>

The month of June opened sadly for Great Yarmouth air station, for on the 4th day Lieutenant T. S. Cresswell, R.M.L.I. (who was much beloved by all on the air station), was killed while flying over the Solent, owing to the folding up of the wings of

<sup>1</sup> Vide also Report of the Advisory Committee for Aeronautics (Cd. 7514).

the Wight seaplane which he was piloting. His passenger—a young naval officer, Commander Rice—was killed also.

This month was of great importance to the Naval Wing because a complete reorganization took place. On the 23rd it was announced that the Naval Wing of the Royal Flying Corps would cease to be associated with the Military Wing, and would come into its own as the 'Royal Naval Air Service'. Under this scheme the new Service was to be administered by the Admiralty, and was to form part of the Military Branch of the Royal Navy. Its officers were not, however, entitled 'to assume the charge and command of a ship unless they belong to one of the existing ranks of the Military Branch and are expressly authorized to do so by superior authority'. It was laid down by the Admiralty that:

'The Royal Naval Air Service, forming the Naval Wing of the Royal Flying Corps, will comprise all naval aircraft and personnel, either for action or reserve service, and will be administered by the Admiralty. It will consist of: The Air Department, Admiralty, the Central Air Office, the Royal Naval Flying School, the Royal Naval Air Stations. All seaplanes, aeroplanes, airships, seaplane ships, balloons, kites and any other type of aircraft that may from time to time be employed for naval purposes. All ranks and ratings of the Royal Naval Air Service will be borne on the books of one of His Majesty's ships, and will serve under the provisions of the Naval Discipline Act accordingly.'

The Military Wing and its reserve, together with the Central Flying School, passed over to the care of the War Office, although it was arranged that a portion of the staff of the Central Flying School would be drawn from the erstwhile Naval Wing. Regulations were issued for the entry of officers from other branches of the Service as well as from civil life, in the rank of Probationary Flight Sub-Lieutenants. All classes of ratings on the 'Active List' of the Royal Navy were eligible for service in the Royal Naval Air Service, and were referred to as 'Mechanics' of various gradings and ranks.

With the creation of the Royal Naval Air Service, new rank titles were authorized, and these became substantive ranks in the Royal Navy and were as follows:

Wing Captain (relative rank of Captain, R.N.).

Wing Commander (relative rank of Commander, R.N.).

Squadron Commander (relative rank of Lieutenant Commander, R.N.).

Flight Commander (relative rank of Lieutenant, R.N.).

Flight Lieutenant (relative rank of Lieutenant, R.N.).

Flight Sub-Lieutenant (relative rank of Sub-Lieutenant, R.N.).  
Warrant Officer, 1st Grade (relative rank of Commissioned  
Warrant Officer, R.N.).

Warrant Officer, 2nd Grade (relative rank of Warrant Officer,  
R.N.).

With regard to uniform, those officers who already belonged to the Military Branch of the Navy wore the uniform of their rank 'with the addition of an eagle on the left sleeve above the distinctive lace'.

Officers of the Marines wore the uniform of their rank and service 'with the addition of an eagle on the left sleeve above the cuff'. These eagles were of gilt metal, approximately 2 inches in length, and showed the bird with outstretched wings and its head inclined to the right. It is related that this eagle was adopted by the Air Department, Admiralty (and approved by the Lords Commissioners), from a sample brooch produced for inspection by Captain Sueter, and borrowed by him from his wife. Some months after its official adoption and issue, Mrs. Sueter is said to have asked her husband what he had done with the eagle brooch which she had 'bought in Berlin', and so the Royal Naval Air Service flew before and during the War of 1914-18 under a German eagle.

Other officers who joined the Service from civilian life wore the uniform of their corresponding rank in the Military Branch of the Navy, with the exception that the anchor on their buttons, cap badge, epaulettes, and sword belt was replaced by an eagle. Because they were of the Military Branch, they were entitled to wear the 'curl' on their gold lace rank-marks, thus distinguishing them from the Executive Branch (engineers, surgeons, paymasters, and instructors) who were not entitled to this distinctive mark. The uniform for all men graded in the new Service was the naval uniform of their rating, with the addition of Air Service distinction badges on the right arm. No ratings were dressed as seamen, but in a single-breasted blue serge jacket with trousers; breeches and puttees were also issued to them.

The new Service came into being on July 1 (1914) and retained its separate existence until the formation of the Royal Air Force, April 1 (1918).

All ranks at Great Yarmouth air station were now (July) engaged in the preparations for the Naval Review which was to be held on July 18-22 (1914) at Spithead, and in which naval aircraft (both seaplanes and airships) were to participate. This Royal

Review was to be attended by flights of seaplanes, one from each of the air stations at the Isle of Grain, Great Yarmouth, Dundee, Felixstowe, and Calshot. Of these flights, 'A' from the Isle of Grain was to consist of Short seaplanes, under the command of Squadron Commander Seddon, R.N.; 'B' from Dundee was made up of similar machines to 'A', and was to be under the command of Squadron Commander Gordon, R.M.L.I.; 'C' and 'D' flights from Felixstowe and Great Yarmouth consisted of Maurice and Henri Farman seaplanes respectively, under Squadron Commanders Risk and Courtney, while 'E' flight from Calshot, under Squadron Commander Longmore, had Sopwith machines and one Short seaplane.

At the appointed time the Great Yarmouth flight flew down to Calshot in two days without any damage being done to the machines. Later, they flew over to Fort Monckton, at the entrance to Portsmouth Harbour, where moorings had been laid down for them. An eyewitness furnishes the following account of the start of the Yarmouth flight on its way to Portsmouth:

'The Yarmouth flight, under Squadron Commander Courtney (Lieutenant, R.N.), all on Henri Farmans with 120 h.p. Gnomes, started at intervals from the opposite side of Calshot "Island", where they had been housed in a big Piggott tent. These machines got off and flew beautifully with 120 h.p. Gnomes (14 cylinders), behaving as lightly in the air as do the ordinary land-going 80 h.p. Farmans. The sprung floats are also good in a slight sea. They are, however, on the light side for really heavy sea-work, which demands a larger machine of much heavier construction.'<sup>1</sup>

The Review opened on the 18th (July), and one who was there described the part that aircraft played as follows:

'On Saturday morning, according to the programme, the seaplanes had to be flown over to the special moorings which had been laid down for them off Fort Monckton, in the entrance of Portsmouth Harbour, in order to be in position for the Review. The Isle of Grain flight, composed of 160 h.p. Gnome-Shorts, under Squadron Commander Seddon, led the way at 5.30 a.m. It was followed by the Dundee flight of 100 h.p. Gnome-Short tractors, under Squadron Commander Gordon, the Maurice Farmans—three with 100 h.p. 12-cylinder Renaults and one with 130 h.p. Salmson motors—from Felixstowe, led by Squadron Commander Risk and the 120 h.p. Gnome-Henri Farmans from Yarmouth with Squadron Commander Courtney in charge. The rear was brought up by the Calshot contingent, under Squadron Commander Longmore, whose machine was, unfortunately, put *hors de combat* at the last moment. It included, however, a 160 h.p. Gnome-Short, a 100 h.p. Green-Sopwith, and a Sopwith bat-boat on which

<sup>1</sup> *Flight*, July 25, 1914.

Flight Commander Travers had made a trip over the assembled Fleet the previous night. After the machines had been moored the pilots and passengers went on board the gun-boat *Niger*, which was acting as mother-ship. It was a disappointment that the King's visit had been postponed, and, after an inspection by the First Lord of the Admiralty, who was accompanied by Lord Fisher and Admiral Sir Hedworth Meux, the seaplanes, about 1 p.m., commenced to return to Calshot.

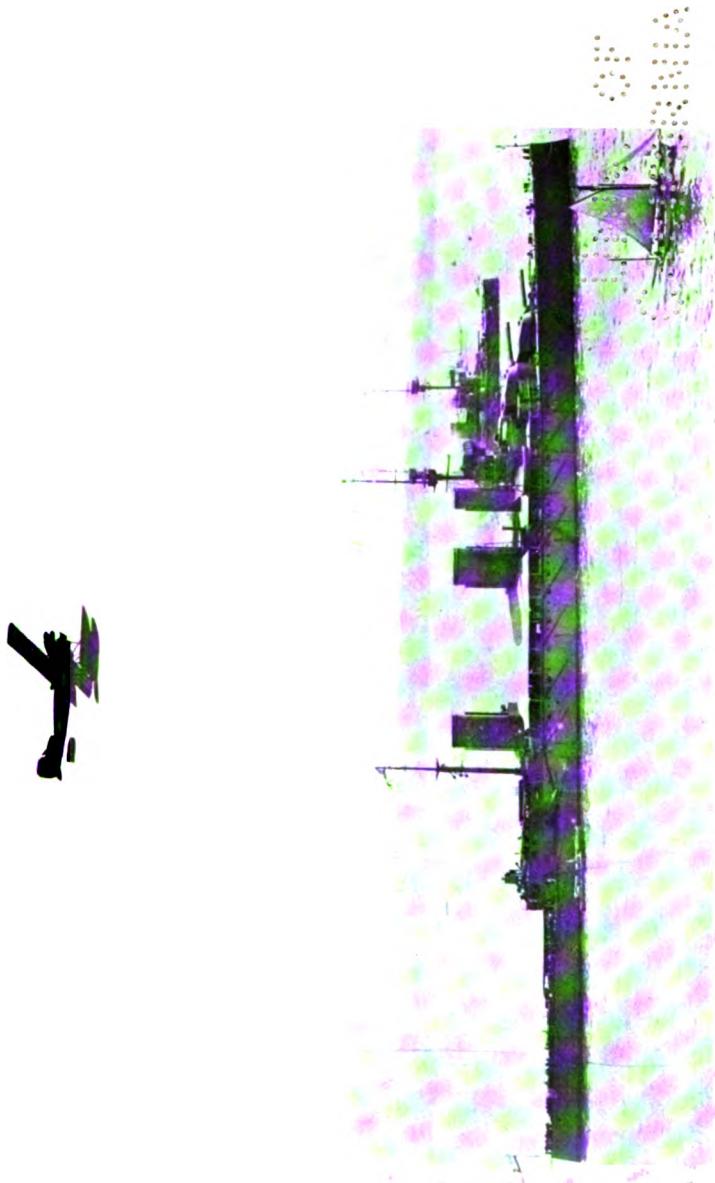
'About 5 o'clock His Majesty arrived at Portsmouth, and the Royal Yacht was escorted out of the Harbour by the Astra-Torres and Parseval airships, which had arrived not long before, the former from Kingsnorth and the latter from Farnborough, while three aeroplanes and several seaplanes carried out a number of evolutions.

'Monday morning opened dismally, after a heavy downpour of rain, but the weather gradually cleared. The turn of the aircraft did not come until the great collection of warships had slowly filed past the Royal Yacht, and out to sea. Then on a message by wireless from a Maurice Farman scout that the last warship had left Spithead, 17 machines set out in single file to fly from Calshot down to the Royal Yacht, on passing which, each one dipped, then banked, showing its number, and returned to Calshot. One machine had to alight, owing to engine trouble, before reaching the Royal Yacht, while another, on the return trip, had to come down, owing to a broken petrol pipe; both were towed in by torpedo boats. The machines which took part in the "fly past" were three of the big 160 h.p. Gnome-Short machines, which have wings capable of being folded back when at rest, four of the 100 h.p. Gnome-Short tractors, four of the 100 h.p. Gnome-Henri Farmans, the Sopwith tractor with its 100 h.p. Green engine, and the Sopwith bat-boat, which has a 90 h.p. Austro-Daimler motor. After this there was a demonstration by three of the land machines from Eastchurch, an 80 h.p. Sopwith and a couple of B.E.'s. They came up in the form of a Vee, and then Commander Samson, on one of the B.E.'s, made some spiral flights which were closely watched by His Majesty. Commander Samson's machine was rejoined by the other two, and they flew off in company, just as another trio, composed of an 80 h.p. Bristol, a 50 h.p. Avro, and a 50 h.p. Short, came out and flew round and over the *Victoria and Albert* for some time.'<sup>1</sup>

The Review was actually a test mobilization of the Fleet, for it had been decided that this should be held instead of the usual summer manœuvres. It was in no sense a surprise test (in that, months before, it had been announced publicly that it would take place<sup>2</sup>), nor was it a real war mobilization, for the men of the Reserves were asked, not commanded, to attend, and officers were appointed, not to their true 'War Stations', but as was convenient in accordance with 'the exigencies of the Service'.

<sup>1</sup> *Flight*, July 25, 1914.

<sup>2</sup> Vide *The World Crisis*, 1911-1914, pp. 189-90.



Commander C. R. Samson, R.N., flying in a Short seaplane over H.M.S. *Lion* during the Naval Review, July 1914.

Digitized by Google

On June 28 the Archduke Franz Ferdinand of Austria (the nephew and heir of the Emperor of Austria) and his consort had been assassinated at Serajevo, the capital of Bosnia. Arising out of this act, the European situation became so threatening (at the time the Review ended) that His Majesty's Government decided that it would be imprudent to disperse the Fleet, and so kept it 'in being'. On July 28 the Admiralty ordered the Commander-in-Chief, Home Fleets (Admiral Sir George Callaghan), to take the Fleet to its 'War Station' at Scapa Flow, and the day after the Admiralty sent the 'Warning Telegram' to all fleets.<sup>1</sup>

All the machines from Great Yarmouth air station did not, unfortunately, return from the Review, for one, piloted by Captain Fawcett, R.M.L.I., landed on the Maplin Sands and became a total loss; the pilot and passenger were saved, however. In addition to this accident, both Squadron Commander Courtney and Flight Lieutenant Sitwell had trouble with their machines, but four of the machines returned undamaged.

At the end of the Review all the seaplanes and airships returned to their bases. The flights of aeroplanes under Wing Commander Samson proceeded on a tour, and flew first of all to Dorchester, where they stayed four or five days, and then to the Central Flying School. They had only been at the School for a few hours when urgent orders were received for the unit to proceed at once to Eastchurch, owing to the strained state of European politics, and they arrived there on July 27. On the same day seaplanes were assembled at the Isle of Grain, Felixstowe, and Great Yarmouth, for the purpose of patrolling the coast in the event of war. The personnel from Calshot air station was distributed amongst these stations. Two aeroplanes were sent from Eastchurch to Felixstowe and one to Great Yarmouth; the two airships remained at Kingsnorth. The Admiralty issued instructions on July 29 that 'in the present stage of aeronautics, the primary duty of British aircraft is to fight enemy aircraft and thus afford protection against aerial attack. . . . After the primary requirement is well provided for, whatever aid is possible for coastal watch and extended defence scouting should be organized.'<sup>2</sup> In pursuance of this policy it also gave instructions that all machines were to be kept ready for immediate action. On the next day (July 30) the Army Council agreed to send No. 4

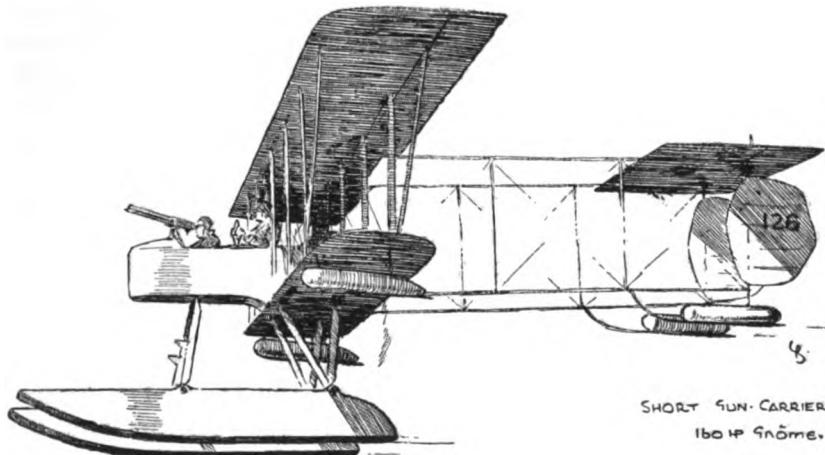
<sup>1</sup> Vide *The World Crisis, 1911-1914*, Chapter IX.

<sup>2</sup> Vide *The World Crisis, 1911-1914*, p. 208.

Squadron, R.F.C. (under the command of Major G. H. Raleigh), to reinforce the naval machines at Eastchurch.

On August 1 arrangements were made to acquire rapidly the services of about 15 civilian pilots, and this was followed two days later by an order forbidding private flying in the United Kingdom within 3 miles of a recognized aerodrome.

On August 4 hostilities broke out, and henceforth this narrative concerns itself mainly with the part played by Great Yarmouth air station as a unit in the fighting forces of the country during the War of 1914-18.



## THE STATE OF DEVELOPMENT IN THE ROYAL NAVAL AIR SERVICE AT THE OUTBREAK OF THE WAR

AT the outbreak of war the Navy had organized a system of aerial patrol around our coasts, which patrol was based on eight seaplane stations situated respectively at Calshot, Dundee, Eastchurch, Felixstowe, Fort Grange, Isle of Grain (with advanced bases at Westgate and Clacton), Killingholme, and Great Yarmouth. There were, in addition, two airship stations, one at Kingsnorth and the other at Farnborough. The total personnel for the manning of these stations was 130 officers (including warrant officers) and approximately 708 men, which number included the petty officers. The total aircraft in the possession of the Royal Naval Air Service was 77 machines. This number was made up of 40 aeroplanes (including 8 school machines), 31 seaplanes, and 7 airships. In view of its historic interest a list of these aircraft is given below:

### AEROPLANES

1	Deperdussin monoplane	with	80 b.h.p. Anzani engine.
1	"	"	70 " "
1	Short biplane	"	50 " Gnome engine.
3	" biplanes	"	70 " "
(Both of these types of Short biplanes were school machines.)			
5	Short biplanes	with	80 b.h.p. Gnome engine.
(Two of these biplanes were school machines.)			
1	Short biplane	with	100 b.h.p. Gnome engine.
1	"	"	140 " "
1	Vickers biplane	"	100 " "
6	Sopwith biplanes	"	80 " "
1	" biplane	"	100 " "
1	"	"	100 " Anzani engine.
5	B.E. 2 biplanes	"	70 " Renault engine.
4	Maurice Farman biplanes	"	70 " "
(Including two school machines.)			
1	Blériot monoplane	with	80 b.h.p. Gnome engine.
1	Bristol biplane	"	50 " "
(School machine.)			
2	Bristol biplanes	"	80 " "
1	Henri Farman biplane	"	80 " "
1	R.E. 5 biplane	"	120 " Austro-Daimler engine.

## 82 DEVELOPMENT IN ROYAL NAVAL AIR SERVICE AT

1 Avro biplane	with 50 b.p.h. Gnome engine.
1 Caudron biplane	90 " "
1 D.F.W. biplane	100 " Mercedes engine.
(A German machine built by <i>Deutsche Flugzeugwerke G.m.b.H.</i> )	

### SEAPLANES

6 Short seaplanes	with 100 b.h.p. Gnome engine.
9 " "	160 " "
1 " seaplane	135 " Salmson (Canton-Unné).
1 " ("pusher gun-bus")	200 " "
1 Wight seaplane	120 " "
3 " seaplanes	200 " "
1 Maurice Farman seaplane	70 " Renault engine.
2 " seaplanes	100 " "
2 Sopwith seaplanes	100 " Anzani engine.
2 " "	90 " Austro-Daimler engine.
2 Henri Farman seaplanes	80 " Gnome engine.
1 R.A.F. seaplane	100 " Renault engine.

### AIRSHIPS

1 Willows (No. 2)	20,000 cu. ft. capacity	35 b.h.p.	Anzani engine.
1 Parseval (No. 4)	300,000 "	2 170 "	Maybach engines.
1 Beta (No. 17)	42,000 "	50 "	Clerget engine.
1 Delta (No. 19)	173,000 "	2 40 "	White & Poppé.
1 Eta (No. 20)	118,000 "	2 90 "	Salmson (Canton-Unné).
1 Astra Torres (No. 8)	229,000 "	2 210 "	Chenu.
1 Gamma (No. 18)	101,000 "	2 45 "	White & Poppé.

It will be seen from this list of aircraft that out of a total of 83 engines only 4 were of British origin—the White and Poppé.

There were a certain number of engines being built in this country at the outbreak of war. They were :

*A.B.C.*—Water-cooled 'V' type.

(The All-British Engine Company, Ltd.) 8-cylinder 100/120 b.h.p.

*Green*.—Water-cooled vertical type.

(The Green Engine Company, Ltd.) 4-cylinder 30/40 b.h.p., a 60/70 b.h.p., and a 6-cylinder 100 b.h.p.

*Isaacson*.—Radial air-cooled type.

(The Isaacson Radial Engine Company, Ltd.) 7-cylinder 60/65 b.h.p.

*Salmson (Canton-Unné)*.—Radial air-cooled type.

(Dudbridge Iron Works, Ltd.) 7-cylinder 80/90 b.h.p., 9-cylinder 110/120 b.h.p., 9-cylinder 120/140 b.h.p., 14-cylinder 160/190 b.h.p.

*Sunbeam*.—Water-cooled 'V' type.

(The Sunbeam Motor Company, Ltd.) 8-cylinder 100 b.h.p.

*Wolseley*.—Water-cooled 'V' type.

(The Wolseley Tool and Motor Car Company, Ltd.) 8-cylinder 60/80 b.h.p. (also built as an air-cooled engine but with water-cooled valves), 8-cylinder 120 b.h.p.

Although these British engines were being built, the two flying Services used engines of French manufacture and design almost entirely.

At the outset it is well to appreciate the bearing of supply conditions upon British aerial policy during the War. The types of machine furnished and their numbers had a powerful influence on questions of policy. Until the end of 1917 there were no supplies of aircraft available, save those necessary to satisfy imperative requirements for purely naval and military purposes. Independent air operations, particularly long-range bombing of enemy territory, were not possible, because there was no weapon with which to execute them. The preoccupation of those at home charged with the duty of making provision for the aircraft and equipment demanded by the commanders in the field and with the Fleet was to satisfy, in so far as they were able, those demands. In turn, the army and naval authorities had to form their policies independently, according to the exigencies of the situation, and in doing so they were governed by what was practicable with the means provided. The Royal Naval Air Service and Royal Flying Corps as such, and as fighting units in the field, had no voice in deciding these policies. They, like any other branches of the Services, were absolutely at the disposals of the staffs of the Commanders-in-Chief who, in turn, had to base *their* policies on material possibilities. What they *could* do was determined by whether or not they had the material by means of which it could be done.

For the first two and a half years of the War the development of aircraft supply was left entirely to the naval and military authorities acting independently. Before the War the Admiralty intentionally developed the aeroplane service—which was outside its normal sphere—in order to supplement the inadequate vote of credit which the War Office succeeded in obtaining for this purpose, but when the War broke out, neither of the Air Services had been developed in a manner commensurate with the requirements of national defence.

The outbreak of war found the science of aeronautics, such as it was, based upon the solid groundwork of research previously

conducted. By much patient endeavour, undertaken by private enterprise, at the National Physical Laboratory, and at the Royal Aircraft Factory, research of an unproductive character hitherto followed had been avoided, and the lines along which future and directly profitable development might be expected were defined. The method of propulsion by means of engine and airscrew was established as the only practicable means of securing flight. The problem of inherent stability had been, to a large extent, solved, for both the R.E. 1 (an experimental reconnaissance machine) and the B.E. 2c—built before the War to the designs of Mr. Geoffrey de Havilland of the Royal Aircraft Factory—had complete inherent stability, and these paved the way for the design of machines with any requisite margin of stability. An inherently stable machine was, however, found to be of little value for aerial fighting, as the possession of a high degree of manœuvrability, combined with a low 'stalling' speed, are some of the essentials for this work.

The aeroplanes of that period were built on sound lines, but their performance was low and their structure not adapted—either in design or strength—for the manœuvres required under war conditions. In 1914 little was known about the magnitude of the forces which might affect a machine in flight, and the strength of an aeroplane was largely based upon arbitrary rules. The outbreak of war caused at once a demand for machines capable of better performances in every respect. Increased lifting power, speed, rate of climb, manœuvrability, and higher 'ceiling' (the maximum height to which a machine can climb) were of prime importance, and, as these requirements are to a certain extent mutually exclusive, much experiment was necessary to produce a satisfactory compromise.

At the outbreak of war, aircraft engine design and manufacture had not reached the same stage of progress as the aeroplane alone, and throughout the War machines were designed to fit the types of engines which were available, and their design suffered accordingly. The 'weight per horse-power ratio' had been reduced to that limit which enabled machines to fly. Beyond this no special adaption to aeroplane requirements *ad hoc* had been attempted.

The development of aircraft for warfare soon emphasized the importance of other factors. The extension of the range of operations and the losses due to engine failure caused insistent demands for greater reliability, while the need for easier maintenance called for engines of improved accessibility. It was soon realized that,

apart from the basic principles of the internal combustion engine, such a type of engine as used for the propulsion of aircraft must differ greatly in detail from that used in automobiles. The Germans realized at an early stage the importance of high-powered engines, and they concentrated on the production of a few simple types. British effort, on the other hand, was divided between widely different types, but at no time was any single type standardized by any belligerent.

This policy caused difficulties in production, and in the early days of the War our engines were not so reliable as those of the Germans. The latter, in the end, however, suffered for their inelastic policy in this respect, while we ultimately progressed much farther than they did, in power and efficiency. In the first six months of the War the British Air Services were dependent almost completely upon French engines—and the goodwill of their manufacturers.

In order that the difficulties of the Royal Naval Air Service may be appreciated, a description of some of their machines, especially seaplanes, is necessary.

The Short tractor seaplane, which was equipped with a 100 b.h.p. Gnome engine, was originally designed as a land machine, but in 1912 it was, by fitting floats in place of the wheeled under-carriage, converted to a seaplane. This type of machine was flown by Commander Samson at the Naval Review and manœuvres at Weymouth in 1912, and became the forerunner of all the Short seaplanes. The machine of this type that was fitted with the 160 b.h.p. Gnome engine was the first to be equipped with folding wings. It was hoped, at the time, that it would be able to carry, and launch, a torpedo, but in practice it was not able to perform this duty satisfactorily. At the Naval Review of July 1914, one of these machines had been fitted in a temporary fashion to carry a 14-inch torpedo weighing 810 lb. The two machines manufactured by the same firm, which were equipped with a French radial engine—the 135 and 200 b.h.p. Salmson (Canton-Unné)—were also intended to be torpedo-carriers. From the very outset the Admiralty had realized the value of torpedo-carrying aircraft (for a design had been prepared in 1913), and, although good fortune had not attended its efforts, the early experimental work paved the way to the success which came a few years later. The name of Lieutenant Hyde Thompson must always be remembered in connexion with the experimental work concerning torpedo-carrying aircraft.

The Wight seaplanes were heavy, clumsy, and capable of little more than leaving the water with the bare load of pilot, observer, and fuel. They were also prone to break their airscrews when 'taxi-ing' on the water, and were, consequently, not successful.

The different Sopwith seaplanes were mostly attempts to provide a torpedo-carrying machine, but these also were not particularly successful.

When considering the merits of the various seaplanes, it is useful to remember that a few days before the Review a conference of the commanding officers of seaplane stations was held at Calshot air station, the object being to discuss whether or not it was desirable in the interest of the Royal Naval Air Service to standardize a type of scouting seaplane for war flights from all air stations. The conference was unanimous in its decision that such a standardization was desirable. The officers were of the opinion, at the time, that the 100 b.h.p. Gnome-engined Short seaplane was the most reliable machine in the Service, but they felt that its value would be enhanced by the fitting of sprung main floats and folding wings. It was decided that, in recommending a policy of standardization of machines, the difficulty of obtaining the different kinds of spares for the varied types of machines would be eliminated, it being, at the time, no uncommon thing for all the machines at an air station to be 'out of service' owing to the absence of some small spare part. As new and more reliable machines were evolved, it was suggested that the whole war flight on air stations should be replaced, in succession, by machines of the new standardized type. The officers in council estimated that, including 6 spare machines, the 5 seaplane stations would require 42 machines during the following year.

Turning now to the land machines in the Royal Naval Air Service, it may be stated that virtually none of them had been designed for the purposes of war, and, in consequence, were not of real value.

From the aspect of suitability for offensive action, all machines were weak, for, as already stated, aircraft armament was still in the experimental state. With the exception of two aeroplanes and one airship, which were equipped with machine-guns, the only offensive weapon carried in aircraft was the 0·45-inch rifle, firing incendiary bullets; only a fairly small percentage of the bullets used were considered to be effective. Machines were also supposed to carry ball ammunition, 'with the idea that some should be

carried in addition to incendiary bullets for use, if necessary, against hostile aeroplanes, or for self-defence, if a landing has to be made in enemy country'. It was also intended that the Marten Hale rifle-grenade should be issued for use from aircraft. These grenades, the invention of Mr. Marten Hale, were first used in the Spanish-Morocco War and in one of the Mexican revolutions. They consisted of a corrugated steel container mounted on a steel rod, the container holding a charge of about 6 ounces of tri-nitro-toluene. The rod fitted closely down the barrel of the 0·303-inch Service rifle, and was loaded from the muzzle. A blank cartridge was used for firing the grenade, the extreme range of which was about 350 yards.

The bombs available consisted of a few 20-lb., Marten Hale type, and one or two 100-lb. bombs that had been made at the Royal Arsenal, Woolwich. These were not supplied with adequate safety devices, and were therefore dangerous to their users. At the declaration of war the incendiary bomb was in the experimental stage, but a few days later successful trials were conducted with one invented by Flight Lieutenant Finch-Noyes. This bomb consisted of a light casing holding 2 gallons of petrol, and fitted with a detonator and means for igniting the petrol. Numbers of these bombs were afterwards manufactured for use by the naval and military Air Services.

Very little work had been done with bomb releases or sights. The Rubery-Owen release gear was the most suitable for use in seaplanes, but it was dangerous if used in aeroplanes. Of the available bomb sights, the most practical and successful were those invented by Lieutenant Scott, U.S.N., and Zeiss. The former won the first prize in the Michelin bomb-dropping competition of 1912; the latter was a telescopic sight. A little later the Workman type, which was a liquid-damped inclinometer with a simple lever sight, was used.

The balanced aerial type of installation for wireless telegraphy was employed, the upper aerial being in the form of an insulated triangle of wire around the planes, which took the place of the 'earth' in installations on land. The radiating member consisted of a trailing aerial operated from a reel under the control of the observer, the amount of wire trailed depending on the wavelength on which it was desired to transmit. The power of the transmitter was 250 watts, this apparatus consisting of a self-exciting alternator (running at a speed of 3,000 revolutions per minute) on the shaft of which was mounted the revolving disk

of a synchronized spark gap, and a Moscicki condenser with a combined primary and aerial coil.

At Great Yarmouth air station 4 Henri Farman seaplanes were equipped with wireless telegraphy apparatus, and the air station itself had a set ashore, which consisted of a Rouzet transmitter and a Brown relay receiving apparatus, the motive power for the alternator being supplied by a Douglas motor-cycle engine.

The air stations at Clacton (advanced base), Eastchurch, Isle of Grain, and Westgate (advanced base) all had shore stations of their own, while for that at Felixstowe the naval one at Harwich was available.

In short, the general condition of the Royal Naval Air Service at the outbreak, and during the first months, of war was that of an experimental Service, and it combined this role with the more serious task of fighting for its existence against a resourceful and well-equipped opponent.

## THE DEVELOPMENT OF THE IMPERIAL GERMAN NAVAL AIR SERVICE UP TO THE OUTBREAK OF THE WAR

IT is convenient at this stage to turn to the consideration of the development of aeronautics in the Imperial German Navy prior to the outbreak of the War. There is, unfortunately, no possibility of giving more than an outline of this development, for it was the rule of the German Government to maintain secrecy about all official aeronautical work. It is, however, common knowledge that it was alive to all that concerned the efficiency of its armed forces, and those responsible had been swift to perceive the possibilities of aeronautics in the prosecution of war.

Before the War Germany had devoted more attention to the development of the airship and the kite balloon than to that of the aeroplane or the seaplane. The first experiments in airships were made with military support, and with definite military intention.

From 1884 an experimental division of *Luftschiffertruppen* (Airship Troops) existed, which in 1901 was transformed into an Airship Battalion (*Luftschifferbataillon*). In 1906, owing to the success attending the Zeppelin airship, the battalion was increased in strength; five years later a further two battalions were added, and yet another two in 1913, but it was not until the last-named year that the Corps, as it was now called, became a section of the 'Military Communication Service' and was directed by an Inspector-General with head-quarters in Berlin.

The Imperial German Navy was much slower than the Army in forming an air Service of its own, for this did not come into being until 1912.

The early progress of the German Air Services was largely bound up with the development of the rigid airship, particularly of the Zeppelin type—the first of which passed into the service of the Army in 1906. It was not until October 1912 that the German Navy purchased its first airship, the *L. 1* (*L.* being an abbreviation of *Luftschiff*—airship), the sixteenth Zeppelin airship to be built. This was a small airship of 22,740 cubic metres (794,000 cubic feet) capacity, with a net lift of 9.25 tons and a

speed of 47 kilometres (29 miles) per hour. After completion at the makers' works (*Luftschiffbau Zeppelin G.m.b.H.*) at Friedrichshafen she made a voyage across Germany over Helgoland, thence westwards over the Baltic Sea, finally landing at her shed at Johannisthal (Berlin), having remained in the air nearly 34 hours. She performed useful work while in the Service, but during the course of some exercises with the German Fleet, on September 9, 1913, she met a heavy thunderstorm and was wrecked. Most of her crew were drowned, including her commander, Kapitän Menzing, who was the first Chief of the Imperial German Naval Airship Service. This officer was succeeded by Korvettenkapitän Peter Strasser, an officer of marked courage and ability.

This airship (*L. 1*) was replaced in 1913 by another of the Zeppelin type, *L. 2*, which was lost on October 10 of that year through catching fire in the air—with the loss of all her crew. She was succeeded by *L. 3*, which was the same size as her immediate predecessor, her capacity being 950,000 cubic feet (27,000 cubic metres), with a net lift of 10.9 tons and a speed of 75 kilometres (46.5 miles) per hour. This was the only airship in commission in the German Naval Airship Service at the outbreak of war.

Although Germany had expended so much energy and devoted so much money to the development of airships, she did not by any means lose sight of the value of the aeroplane and seaplane. In November 1910 the military authorities began to purchase aeroplanes, several Etrich monoplanes (a machine which afterwards developed into the *Taube*) being ordered. Previous to this purchase the Wright biplane seemed to be the most favoured for military purposes. In 1910 the majority of German flying officers were in favour of the monoplane as opposed to the biplane. Further progress took place in the next year, and it was estimated that from 12 to 20 machines were in use at the Döberitz Military School, and there were, in addition to this number, probably 100 civilian machines in the country owned by firms or professional aviators who lived by giving exhibitions and taking passengers for short flights. By the end of the year (1911) two aeroplane sheds had been erected on the Island of Holm, Danzig, and preparations were being made for the erection of sheds and quarters for a naval air station at Putzig, on the north-western shore of the Gulf of Danzig. This station was finished in 1912.

The aeronautical service of the German Navy, as already stated,

came into existence later than that of the Army, and, on its formation, aeroplanes and airships were under the same control, but early in 1913 the two methods of flying were given separate organizations—the *Marine-Luftschiffabteilung*, in which was grouped the entire naval airship Service, and the *Marine-Fliegerabteilung*, which included all that concerned naval aviation. Both remained essential parts of the German Navy and, as such, were under the orders of the Admiralty in Berlin. The *Marine-Fliegerabteilung* was under the command of the *Befehlshaber der Marine-Flieger* entirely for administration, and, in a large part, for operations. As in the Royal Navy, the German Navy had both land machines and seaplanes. The land machines were grouped as *Marine-Landflieger*, and were allotted variously to the home aerial defence command or to the *Marine-Korps*.

During 1912 it was estimated that the Services had between 120 and 150 machines, but the exact figures were not obtainable. It was believed that during the year (1912) 68 machines were ordered, 48 of which were monoplanes. Divergent reports existed at the time as to whether or not these seaplanes were satisfactory; it was stated in the German press in October (1912) that the Emperor had expressed his dissatisfaction with the general progress of German naval aviation. It is known that the first seaplane competition held in the autumn at Heiligendamm (some 20 miles west of Rostock) showed that the machines (which, with the exception of the engine, had to be of German construction) were not capable of the duties considered to be necessary. After this competition the German Admiralty sent a note to all aircraft constructors in which were stated the desiderata for naval seaplanes. This note may be summed up as follows. The seaplane must be able to carry its pilot and a passenger weighing together 396 lb.; to transport fuel and stores for a flight of 4 hours; to travel at a speed of at least 62 miles an hour; to alight on the open sea with a wind blowing at 25 miles an hour; to remain floating on that rough sea during one hour with the engine stopped and to fly off that rough sea; to fly off calm water, and to execute an uninterrupted flight of 3 hours without any engine trouble. In addition to the possession of the above-named qualities, the seaplane was to be provided with two seats, each giving its occupant an unintercepted view in front and below, and all controls had to be within reach of the passenger as well as of the pilot, both of whom should be able to start the engine. The seaplane had to be provided with a device

92 DEVELOPMENT OF THE IMPERIAL GERMAN NAVAL  
to permit of its being hoisted off the sea and placed on board  
ship.

By the end of the year (1912) the German Navy was said to possess 10 machines of the Albatross, Pfeil, Rumpler, and Curtiss design, of which only 4 were seaplanes. The latter had been built by *Albatroswerke G.m.b.H.*, Johannisthal.

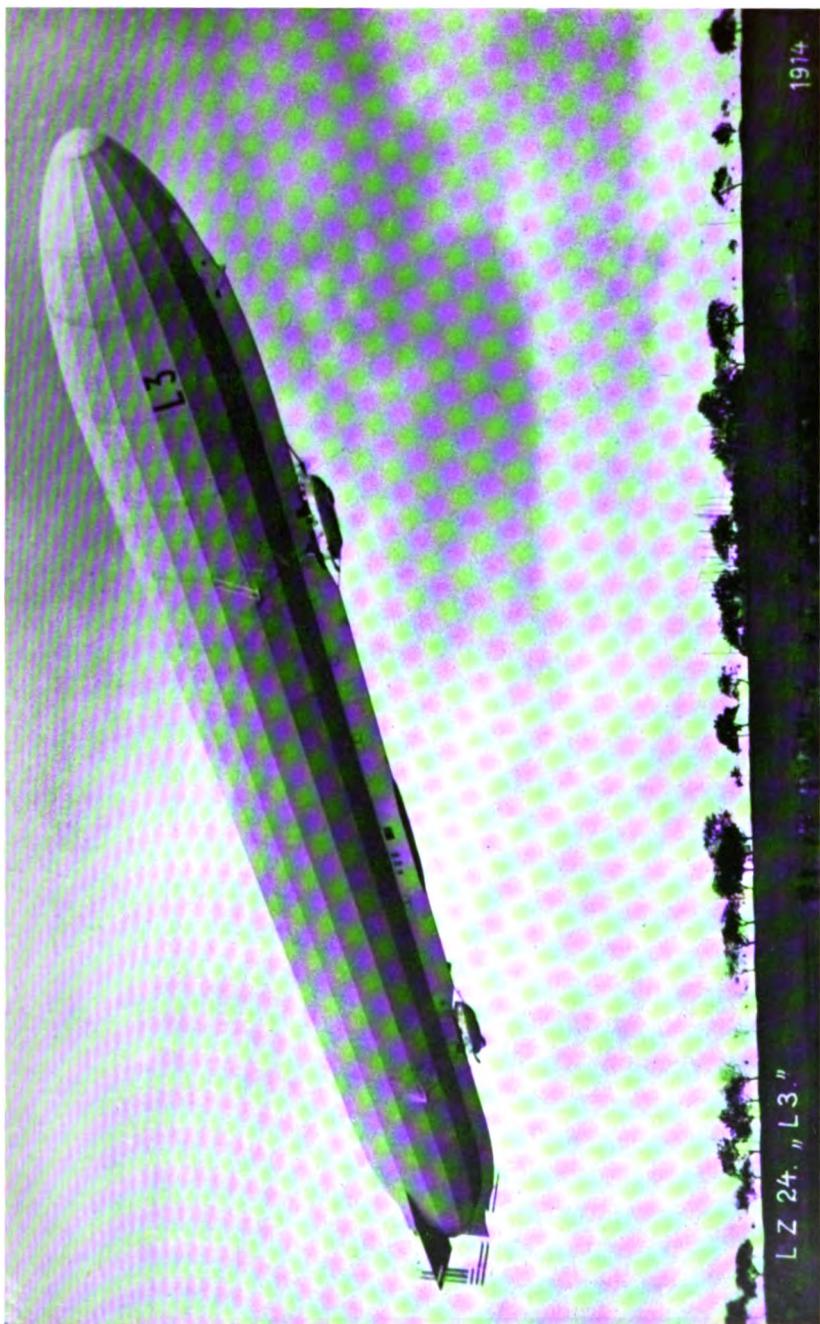
In 1913 further improvements took place; naval air stations were built at Cuxhaven, Putzig, Kiel, Wilhelmshaven, and Helgoland. The station at Cuxhaven was the head-quarters (*Marine-Luftschiffabteilung*), and it was understood that the normal establishment was to be 6 machines on each air station, but the stations were to be built large enough to accommodate 10 machines. There was to be a total reserve of 14 machines.

Before the War the German Air Services are known to have directed considerable attention to increasing the offensive—especially the bombing—powers of aircraft. Some obsolete torpedo boats, it is believed, had been sunk by bombs, but attacks on the old battleship *Bayern* with bombs of similar size had met with little success. A start had also been made with the establishment of an anti-aircraft defence force. The force was equipped with a number of 'high-angle-fire' guns with efficient ammunition. Experiments had also been conducted with the protective colouring of submarines, in order to render them less easy of detection from the air, but with little positive results of value.

Despite the secrecy exercised by those in control, it was reported that the wireless telegraphy installations fitted in the Zeppelin airships were capable of transmitting messages over a range of 300 miles, and experiments were known to have been made in 1913 with directional wireless telegraphy.

Considerable attention had been paid to armament, and it was believed that the later types of Zeppelin and Schütte-Lanz airships were fitted with platforms for machine-guns, one on each car and two on the top of the envelope. The airships were reputed to carry bombs weighing 660 lb., consisting of a steel case containing tri-nitro-toluene with steel bullets disposed in the explosive charge.

By July 1914 it was known that the German Navy had three rigid-type airships on order (two of the Zeppelin and one of the Schütte-Lanz type), while the Army had 17 rigid and non-rigid airships in commission or under construction. There were also, in addition to these, 7 airships in the country which were privately



L 3.



owned. A large number of sheds suitable for the reception of these airships, together with the necessary hydrogen-generating plant, had been built.<sup>1</sup> At the outbreak of war the Navy had only one airship, *L. 3*,

'a fact that one might consider somewhat strange when one thinks that the airship must have seemed the most suitable means of carrying out observation patrols over the seas and raids on countries otherwise out of reach. No doubt, however, the reason for this meagre provision of ships lay in the fact that they were clearly not capable of working under the exacting conditions demanded by the Navy, conditions which made it necessary that long distances be covered.'<sup>2</sup>

On the mobilization of the German forces, the Zeppelin airship *Viktoria Luise* (the property of *Deutsche Luftschiffahrt A.G.*—the 'German Airship Transportation Company') and the Parseval semi-rigid airship *M. IV* were handed over to the Navy. The *Sachsen* (also belonging to *Deutsche Luftschiffahrt A.G.*) was based at Johannisthal for the training of officers and crews.

As the Army airships co-operated with the Navy up till 1917, it is of interest to note that at the outbreak of war the disposition of the former was as follows:

On the Western front:

- Z. *VI* in the shed at Cologne.
- Z. *VII* in the shed at Baden-Dos.
- Z. *VIII* in the shed at Treves.
- Z. *IX* in the shed at Dusseldorf.
- Z. *Sachsen* (of *Deutsche Luftschiffahrt A.G.*) in the shed at Frankfurt-am-Main.

On the Eastern front:

- Z. *IV* in the shed at Königsberg.
- Z. *V* in the shed at Posen.
- S.L. *II* (Schütte-Lanz) in the shed at Liegnitz.

That Germany entertained great hopes for her lighter-than-air craft in the event of war with England is well known. At a lecture given at Kiel in 1912 by Kapitän von Pustau, he said:

'Let us imagine a war with England—England which from time immemorial has had an unwarlike population . . . if we could only succeed in throwing some bombs on their docks, they would speak with us in quite different terms. With airships, we have, in certain circumstances, the means of carrying the war into the British country, and in England one imagines

<sup>1</sup> Vide *Taschenbuch der Luftflossen*, 1914, pp. 8-13 and 104-7.

<sup>2</sup> Vide *Die deutschen Luftstreitkräfte im Weltkriege*, p. 11. (English edition.)

## 94 DEVELOPMENT OF THE IMPERIAL GERMAN NAVAL

with terror that one can already hear the beating of the screws of the Zeppelin cruisers. . . . And now to return to a possible war with England. It is true that this country has several aeroplanes stationed along the south coast, but their craft cannot manoeuvre at night, and can, therefore, afford no protection against airships.'

Although too much value must not be placed on chauvinistic statements like this, it is known that the German naval authorities rated the Zeppelin airship highly as a weapon of reconnaissance, but they were not able to obtain enough of them, owing to the jealousy of the Army authorities.

At the outbreak of the War it is believed that their Naval Air Service had about 36 aeroplanes and seaplanes—including a Wight seaplane and a Sopwith flying-boat—the 'Bat-boat'. Their Service did not use land machines for sea patrols.

There were five makes of seaplanes in Germany in 1914. They were:

*Ago.* A twin-float 'pusher' biplane equipped with the 150 b.h.p. Argus engine, speed 90 kilometres (56 miles) an hour.

Makers: *Ago-Flugzeugwerke G.m.b.H.*, Johannisthal and Travemünde.

*Albatross.* (1) A twin-float tractor biplane equipped with the 100 b.h.p. Argus or Mercedes engine, speed 95 kilometres (59 miles) an hour.

(2) A twin-float 'pusher' biplane, similar in appearance to a Maurice Farman seaplane, equipped with the 100 b.h.p. Argus or Mercedes engine, speed 90 kilometres (56 miles) an hour.

(3) A twin-float tractor monoplane equipped with the 100 b.h.p. Mercedes engine, speed 100 kilometres (62 miles) an hour. This machine was also built as a land machine.

Makers: *Albatroswerke G.m.b.H.*, Johannisthal.

*Friedrichshafen.* (1) A single-float 'pusher' biplane with a cruciform tail equipped with a 135 b.h.p. Mercedes engine, speed 110 kilometres (68 miles) an hour.

(2) A twin-float tractor biplane equipped with a 100 b.h.p. Mercedes engine, speed 115 kilometres (71 miles) an hour.

Makers: *Flugzeugbau Friedrichshafen G.m.b.H.*, Friedrichshafen. (This firm was, and is (1928), a subsidiary firm of the Zeppelin concern.)

*D.F.W.* A small 'pusher' biplane flying-boat (the lower main planes had a pronounced dihedral angle) equipped with a 100/120 b.h.p. engine (Benz or Mercedes), speed 90/100 (56/62 miles) an hour.

Makers: *Deutsche Flugzeugwerke G.m.b.H.*, Leipzig.

*Rumpler.* A twin-float tractor monoplane equipped with a 100 b.h.p. engine (Argus or Mercedes), speed approximately 90 kilometres (56 miles) an hour.

Makers: *E. Rumpler Luftfahrtzeugbau G.m.b.H.*, Johannisthal. This company was formed in 1909 for the purpose of manufacturing Etrich 'Taube' machines in Germany, and the early machines were similar to

the original Etrichs, but later several modifications were introduced. As in the Etrich, the main characteristic consisted of the Zanonia leaf wing-form.

The Imperial German Naval Air Service was supplied with more reliable aircraft engines than the Royal Naval Air Service, for the Germans had developed, by 1914, a small but efficient aircraft engine industry. There were eight manufacturers of such engines, and they were:

**Argus.** Water-cooled vertical type engines.

(*Argus-Motoren G.m.b.H.*, Berlin.)

4-cylinder, 70/80-100/110-140/150 b.h.p.

6-cylinder, 115/120-120/130-140/150 b.h.p.

**Benz.** Water-cooled vertical type engines.

(*Benz & Cie*, Mannheim.)

4-cylinder, 100/105 b.h.p.

6-cylinder, 85/95-100/110-150 b.h.p.

One of these engines won the first prize in the 'Kaiser Engine Competition' of 1913.

**Austro-Daimler.** Water-cooled vertical type engines.

(*Austro-Daimler Motoren G.m.b.H.*, Weiner Neustadt.)

4-cylinder, 62/70-85/95 b.h.p.

6-cylinder, 75/85-95/105 b.h.p. (two models), 170/180 b.h.p.

8-cylinder, 125/140-230/240 b.h.p.

**Korting.** Water-cooled vertical and 'V' type engines.

(*Gebr. Korting A.G.*, Kortingdorf.)

4-cylinder, 36 b.h.p.-40 b.h.p.

6-cylinder, 180 b.h.p.-200 b.h.p.

8-cylinder, 'V' type, 50 b.h.p.-75 b.h.p.

These engines were also used by the Austrian, Japanese, and Russian air services.

**Maybach.** Water-cooled vertical type engines.

(*Motorenbau G.m.b.H.*, Friedrichshafen a. B., a subsidiary of the Zeppelin concern.)

6-cylinder, 180/190 b.h.p.

This engine was then, as afterwards, the standard engine for Zeppelin airships.

**Mercedes.** Vertical (and inverted) water-cooled engines.

(*Daimler-Motoren A.G.*, Stuttgart-Untertürkheim.)

4-cylinder, 62/70 b.h.p. (inverted).

4-cylinder, 85/95 b.h.p. (inverted).

6-cylinder, 75/85-95/105-170/180 b.h.p. (vertical).

8-cylinder, 125/140-230/240 b.h.p. (vertical).

The last of these engines had been largely used in German airships.

*N.A.G.* Vertical water-cooled engines.(Newe Automobil-*A.G.*, Berlin-Oberschöneweide.)

4-cylinder, 55/60-95/100 b.h.p.

6-cylinder, 135/150 b.h.p.

*Stahlerz.* Rotary air-cooled engines.(Otto Schwade *A.G.*, Erfurt.)

7-cylinder, 45/50-63/70-75/80 b.h.p.

9-cylinder, 100 b.h.p.

18-cylinder, 200 b.h.p.

As a matter of fact, only Mercedes engines of 100 b.h.p. were used in the machines operating over the North Sea during the first weeks of the War, because of their well-established reliability.

Some idea of the general conditions of their Naval Air Service at the outbreak of the War can be gathered from the following account:

'Before the War, seaplanes were like the step-children to the Navy, for practically nothing was expected of them; it was on airships that the Navy relied for reconnaissance and observation patrols. If seaplanes were not exactly thought of as playthings, they were not, at any rate, taken seriously, and were very badly off for men, material, and money. The Naval Air Service, to which the seaplane station was attached, had its base at Putzig. There were also seaplane stations at Kiel, Helgoland, and Wilhelmshaven. The total strength of the personnel before the War was about 200, so only Putzig and Kiel could be maintained at full strength. Helgoland and Wilhelmshaven were only used as landing-places during the manoeuvres. About 20 flying officers, almost all of whom were young naval officers, had been fully trained before the War, but amongst them there were no observers. In case of general mobilization, it was assumed that young officers should be taken from the Fleet, and that they should be relied on to carry out observers' duties without any special training. The existing supply of aeroplane material was not sufficient to satisfy the most modest demands, either in quantity or in quality. Money for further enterprise and research had to be found as soon as seaplanes showed signs of promise. One might ask how any promise at all could be found, since we did not possess a single serviceable machine. When we first attempted to build seaplanes, along with the other Great Powers, no endeavour was made to design a special type for the purpose, owing to the need for economy; floats were, therefore, fitted to land machines. It soon became clear that this state of affairs would lead nowhere. Seaplanes were brought from England and America and French racing machines were investigated; then we set to work building types of our own. The result of this was the existence of many different types at the beginning of the War. The hangars at Holtenau were like a museum. Between German machines with fuselages and tail booms, there stood the productions of English, American, and Austrian

designers. . . . Our first service machines were anything but seaworthy. A forced descent on the open sea caused damage at the very least, and frequently the loss of both machine and men. We have only the reliability of the German engine to thank for the fact that the entire Naval Air Service was not annihilated in the early days of the War. The German aircraft industry was situated in the interior, and the designers had frequently had no experience of the sea except as bathers. Seaplanes were, therefore, designed from theory alone, and were not constructed in accordance with practical experience. . . . In Helgoland, during the first weeks of the War, there were only 6 machines ready to operate with the High Sea Fleet, and only 3 machines were serviceable for observation work over the fairways of the Baltic. . . . The performance of our seaplanes was first confined by their limited petrol capacity to a radius of action of 75 nautical miles, and therefore to a total flying limit of 150 nautical miles . . . when fully laden with petrol for 4 hours, two occupants, the necessary appliances for signalling (though they carried no wireless and could only communicate information to the ships at sea by means of signalling taps), but without either armament or bombs, these machines could only attain a speed of 65 miles per hour and could not rise above 3,000 feet. On special occasions when more petrol, bombs, or anything else had to be carried they were not powerful enough to rise from the water, should there be even a slight wind blowing.'<sup>1</sup>

The general difficulties of their Naval Air Service were well summarized by one of their officers, who said that 'the senior naval officers had no means of judging the probable usefulness of the seaplane, and in naval circles the confidence of the flying officers in their weapons was merely laughed at'.

Their Naval Air Service had one advantage over ours in that its seaplane stations were all situated in more sheltered waters. The general progress of German aviation may be judged by the fact that in the month preceding the outbreak of the War, one German pilot had flown for just over 24 hours without alighting. Another had raised the world's height record to more than 18,000 feet, and another, with a passenger, had flown from Berlin to Egri Palanka on the Turco-Bulgarian frontier, just over 1,000 miles, without landing.

No account, however short, of our late enemy's Air Services would be complete without some tribute to its personnel. Probably the best testimony is that paid by a distinguished British naval officer, who, a few days before the outbreak of the War, wrote:

'They are still learning to fly and have not seriously considered the question of fighting aeroplanes. The standard of skill and dash among the flying

<sup>1</sup> *Die deutschen Luftstreitkräfte im Weltkriege*, pp. 57 et seq. (English edition.)

officers has risen during the last year in a truly remarkable manner, and the spirit which obtains in the flying battalions leaves nothing to be desired. The attitude taken towards accidents, fatal or otherwise, is a thoroughly virile one, as might indeed have been expected from a nation which is so essentially manly and which is always preparing itself for war. Officers who are killed at their work are regarded as having lost their lives in action. Very little sentiment is permitted. Relentless prosecution of the art of flying is the order of the day.'

This opinion was amply borne out by the experience of our own Air Services during the period of the War. Brave, dashing, chivalrous, and skilful, they were opposed to us in action, although we were identical in spirit.

## VII

### THE FIRST MONTHS OF THE WAR AT GREAT YARMOUTH AIR STATION

DURING the first month of the War the activities of the Royal Naval Air Service were directed almost entirely to the work of coast defence. A few days before the outbreak, the Inspecting Captain of Aircraft at the Central Air Office, Sheerness (Captain F. R. Scarlett, R.N.), had issued orders for the establishment of Channel patrols by seaplanes based on the air stations at Clacton, the Isle of Grain, and Westgate. The intention was to bring about a concentration of machines in this area, rather than to keep a constant patrol over the Thames estuary, so that, in the event of war, a system of patrols could be put into operation at once.

Four days after hostilities started, the Admiralty issued orders (August 8) for the further establishment of a coastal and cross-Channel aerial patrol. It stated that arrangements were being made to institute a regular patrol by aeroplanes from Kinnaird Head, in Aberdeenshire, to Dungeness, in Kent. The most vulnerable part of the east coast, from the Forth to the Thames, or from North Berwick to Clacton, was to be patrolled by the Royal Naval Air Service. The naval machines were detailed for these duties in flights of four. Part of the task of patrolling the coast was delegated to the Royal Flying Corps, because the German occupation of the Belgian coast made necessary a concentration of naval machines in the Thames estuary, in view of the possibility of bombing raids being made on London.

The Royal Flying Corps, or rather, such incomplete squadrons of the Corps as were not yet ordered abroad, undertook the northern and southern extremes of this patrol, that is to say, the northern section between the Moray Firth and the Firth of Forth, from Kinnaird's Head to Fife Ness, and the southern section between the Thames and the coast of Sussex, from the North Foreland to Dungeness. These patrols were not popular with the Corps, because they deprived it of a number of pilots and trained mechanics whose services, it was contended, would be employed more usefully in training new pilots for service in France. Moreover, on such patrols the Corps had to use machines

which were never designed for the purpose, and whose loss, it was felt, would 'have all the effects of war on both personnel and equipment without any probability of anything useful being accomplished'. The machines carried Véry pistols with red lights or parachute flag signals, and a code was established for communicating the presence of hostile craft to the Admiralty war signal stations. Furthermore, a seaplane patrol of the Channel between Westgate and Ostende was instituted, and orders were given to establish a temporary seaplane base at the latter place. This station was commissioned on August 13, under the command of Flight Lieutenant E. T. R. Chambers. This officer commanded Great Yarmouth air station at the end of the War.

In addition to these steps, arrangements were made for airships to patrol over the Channel during the transport of the British Expeditionary Force to France.

On August 10 the system of coastal patrols was reorganized: Wing Commander Samson was ordered to establish a base at Skegness and to take charge of the aerial patrol of the coast from the Humber to Cromer, including the defence of Immingham. Patrols from Great Yarmouth to Cromer, and Great Yarmouth to Southwold, were started under Squadron Commander Gregory, and another one, from Harwich to Southwold, under Squadron Commander Risk. It was arranged also that Wing Commander Samson was to keep a reserve of machines to reinforce, if necessary, Great Yarmouth and Killingholme. Felixstowe air station was to be strengthened from the one at Eastchurch.

On the declaration of war some additional naval squadrons were formed, and on August 11 the Admiralty took over from the South Eastern and Chatham Railway Company three of its cross-Channel steamers—the *Empress*, the *Engadine*, and the *Riviera*—and converted them into seaplane-carriers. Two squadrons of aeroplanes manned by the Royal Naval Air Service were sent to Belgium with the Naval Division in an attempt to defend Anvers, and the aircraft operating from the seaplane-carriers undertook some of the duties in connexion with the protection of the shipping channels off the east coast of England and later made some attacks on German naval bases. The squadrons with the Naval Division were the nucleus of the force which was later formed at Dunkerque.

Within a few days after the outbreak of war, as was to be expected, the Admiralty Air Department was inundated with

applications from civilians who wished to join the Royal Naval Air Service. The urgent need for training additional pilots over and above those which could be accommodated at naval air stations and the Central Flying School led the Department, on August 17, to make arrangements for officers to be sent to civilian schools for a preliminary training in flying. The Bristol School at Brooklands, and the Grahame-White School at Hendon, and, later, the Eastbourne Aviation School were used for this purpose. An additional training flight was also attached to the defence flight at Hendon air station. At the civilian schools the pupils were instructed in flying only so far as was necessary to qualify for the Royal Aero Club's Aviator's Certificate, and then, in the majority of cases, they were discharged afterwards to the Central Flying School or to Eastchurch air station to finish their aeroplane flying training, before taking the seaplane course at Calshot.

In accordance with the terms of the establishment of the Royal Naval Air Service, all selected entrants from civilian life were granted commissions as Probationary Flight Sub-Lieutenants.<sup>1</sup> The entry of specialist officers was similar, except that they were not required to qualify to become pilots.

Reverting to the subject of coastal patrols, it may be said that it has been the aim, so far, in this narrative, while devoting attention mainly to an individual air station, to give, in passing, some account of the general development of the Naval Air Service, for such development naturally affected all naval air stations. The remainder of the story will be devoted, largely, however, to recounting the operations conducted by the personnel of the air station to which this narrative mainly refers.

On August 4, 1914, Great Yarmouth air station was commanded by Squadron Commander R. Gregory, who had under his command 7 officers, 2 warrant officers, and 40 ratings. The officers (all of whom were flying officers) were Captain H. R. Fawcett, R.M.L.I., Lieutenants R. J. Bone, C. L. Courtney, W. G. Sitwell, H. A. Williamson, R.N., and Sub-Lieutenant R. H. Kershaw, R.N.R. Lieutenant C. E. Maude, R.N., was absent on 'detached duty' at the Admiralty Air Department. The warrant officers were Mr. H. C. Bobbett (boatswain (G), R.N.) and Mr. L. R. Staddon (carpenter, R.N.). The former was a

<sup>1</sup> For an account of the training of such officers at this period vide *In the Royal Naval Air Service*, pp. 13-20.

qualified pilot and had the distinction of being the first naval warrant officer aviator. The majority of the men subsequently attained to higher rank, many receiving commissions. Amongst them should be mentioned Engine-Room Artificers H. Hackney, C. H. V. Hayman, V. Lurie, P. Dampier, Chief Petty Officers J. Maxwell, R. Edwards, B. J. Harper, Petty Officer I. C. Hendry, Leading Mechanics V. F. Whatling, F. H. H. Twelvetree, C. Pooley, and Air Mechanics A. Stoward, C. Notley, J. Brownlee, W. J. Caple, W. Edwards, and G. Stratton. There were three pensioned Chief Petty Officers, Clowes, Deary, and Shuttler, employed in a civilian capacity, but they all rejoined the Service as soon as the War started. There were also several Boy Scouts on the station who were used as messengers and signallers. They received part of their training from a young Midshipman of the Royal Navy—R. England Ferrier—who gave up his leave to do this work. This officer, who was but a boy, was afterwards killed in action on December 12, 1917, when the destroyer *Partridge* was sunk during a raid by German destroyers on a convoy which the *Partridge* was escorting.

The first war patrol from Great Yarmouth air station was flown on August 9, when three flights were made. One pilot reported that he 'had followed two German seaplanes along the coast'—but he would appear to have been mistaken. As a precaution, however, No. 154 (D.F.W. biplane), which was at a neighbouring aerodrome, was ordered 'to remain on the ground, in case she was mistaken for the enemy, being of German type'.

On August 14 a system of patrols was started known as the 'Dawn', 'Midday', and 'Sunset', and these were flown, with modifications, to the end of hostilities. It may be said that, in the early days of these patrols, navigation depended mainly on chart reading. Machines were fitted with compasses, but these were of indifferent design and unreliable, for the errors involved when using nautical compasses for the steering of aircraft had not been realized before the War.

The following 'daily report' is typical of those in the first months of the War:

- 'Weather. Light air, blue sky and cloudy.
- 6.30 a.m. Aeroplane No. 152 left Yarmouth for Cromer and vicinity.
- 7.20 a.m. Turned round Cromer.
- 8.0 a.m. Returned to Yarmouth. Passed British destroyers. Nothing to report.
- 11.40 a.m. Aeroplane No. 69 left Yarmouth for Hunstanton.

- 12.15 p.m. Arrived Hunstanton and in accordance with orders landed and remained two hours.
- 2.10 p.m. Left Hunstanton for Yarmouth.
- 4.30 p.m. Seaplane No. 142 left Yarmouth for deep-sea scouting to Smith's Knoll and outer light vessels as enemy had been reported in that vicinity. Saw nothing.'

This is a typical report made by a pilot after a patrol at this period:

*'Report on Seaplane No. 142'*

Pilot—Squadron Commander C. L. Courtney.

Passenger—P.O. Telegraphist Hendry.

Wind—E.—10 m.p.h. Weather hazy.

4.30 p.m. Left Yarmouth.

4.31 p.m. Passed a T.B.D. and signalled her.

4.35 p.m. Passed Cross Sands Light Vessel—1,000 feet.

4.40 p.m. Passed H.M.S. *Spanker* and reported by W/T.

4.55 p.m. Descended at Smith's Knoll Light Vessel and tied up astern. Asked for information as to enemy ships. (Nothing.)

5.0 p.m. Ascended and steered north 10 miles at 600 feet.

5.10 p.m. Laid course for Newarp Light Vessel.

5.20 p.m. Passed Newarp, laid course for Yarmouth—800 feet.

5.35 p.m. Arrived Yarmouth. Nothing to report.'

These patrols were flown for the rest of the year, but no enemy craft, surface or air-borne, were sighted. Even had the enemy been seen, the machines would not have been able to attack them with much hope of success, owing to the lack of armament. On August 25 the air station had only 6 Hale grenades and no bombs. The whole of the Royal Naval Air Service was woefully short of machine-guns and bombs.

It may be mentioned that for the purpose of providing an aerial defence for the Grand Fleet and for scouting and patrol duties, air stations had been established, on August 11, at Scapa Flow and Thurso. These stations were merged, shortly afterwards, into one at Scapa Flow. They had been manned largely by officers from Great Yarmouth air station, and two of the Henri Farman seaplanes employed were taken from that station. Flight Commander Douglas A. Oliver was the Flight Commander at Scapa Flow. This officer afterwards commanded Great Yarmouth air station with distinction.

Early in September Squadron Commander Courtney and Flight Lieutenant Bone were sent to Killingholme, and Flight Lieutenant Tomkinson and Flight Sub-Lieutenants Barr and Lan-

Davies and Lieutenant the Earl of Carnwath, R.N.V.R., joined the air station.

At the beginning of this month there were 6 officers and 58 ratings at the air station, the majority of whom were living there under canvas, so that they could be ready for action at any moment, for, although the Coast Defence Station had been taken over on January 6 (1914), owing to difficulties of accommodation the officers were not 'quartered and victualled' until September 14.

During this month there were only 8 machines on the station:

*No. 69. Maurice Farman biplane, 70 b.h.p. Renault engine.*

*No. 152. Short biplane, 80 b.h.p. Gnome engine fitted with dual control.*

*No. 156. Henri Farman seaplane, 80 b.h.p. Gnome engine.*

*No. 20. Short seaplane, 100 b.h.p. Gnome engine.*

*Nos. 880, 897, 898, and 899. Sopwith seaplanes, 100 b.h.p. Gnome engines. The last three machines were classified as 'Gun Machines' and 'Bomb Doppers'.*

It was during September that a start was made with the arming of the machines, for in the 'daily report' of the 5th it was stated that 'a hole is being cut in the fuselage of No. 880 to permit a rifle being fired from her by a passenger', and a few days later dummy bombs were dropped from another machine, but it was not until a couple of months later that the machines were fitted for the carrying and release of live bombs.

To recount all the patrols that were flown from the air station at this period would be wearisome, for generally the pilots had 'nothing to report'. One who was a chief petty officer at the time, writing of this period, said that:

'any old 'bus was pressed into service and coastal patrols were carried out by a Maurice Farman and a Short "Sociable" (two seats abreast). The former soon left for Eastchurch and the latter crashed. Next arrived one or two Sopwith two-seaters, 80 b.h.p. Gnome, which continued the patrols, that is, flying one way only, as they were usually found in the country fields with tail up or wheels up. It might be mentioned that the skilful pilot of those days was he who was capable of landing near or on the lawn of some mansion, so that he could be near a telephone. The collecting party, arriving later in lorries, were also agreeably surprised at the pilot's skill, as it usually meant a good feed. That was, of course, in 1914; familiarity, as in most cases, bred contempt, and we soon became just ordinary people.'

Because most of the machines were 'awaiting spares' practically no flying was done during October, but the personnel was by no

means idle, as may be gathered from the following account written by another chief petty officer:

'The first batch of War Mechanics arrived about October. The names are a matter of interest. They were Leading Mechanic Jones, Air Mechanics Pennel, Lincoln, Latter, Garrod, Campbell, and Osmond. It was a curious sight to see them but we soon took them in hand and broke their hearts. From this time onward fresh ones came along and so the station expanded around a nucleus of naval officers and ratings. . . . By degrees the men living out were brought in to occupy the cottages as the Coastguard families moved out. The senior Chief Petty Officer H. Hackney, E.R.A., took over the duties of Master-at-Arms in addition to his engine duties. Later, a ship's steward R.N. (Dodd) relieved him. The latter promptly brought into practice a ship's routine, which was never shaken off entirely, even when Dodd went back to the Navy proper, to be lost at Jutland. One can only mention that progress at this time, although slow, owing to lack of facilities, drawings, and special tools, was maintained, and many big constructional jobs were undertaken to meet the new requirements of the Service, such as, reconstructing the Flanders biplane—improvising grenade racks for dropping in series—mounting machine-guns. Although, to the aeronautical engineer of to-day this would appear child's play, it is contended that without any means of guidance as to dimensions, stresses, and the like, the senior Chief Petty Officers of departments took on a great responsibility in carrying through the work. One case alone is typical of this, that of the Flanders biplane.

'This machine was purchased by the Admiralty. By a series of hops she made her way, finally coming to rest some distance away from anywhere. She was dismantled with the aid of a few farm hands complete with axes, saws, and no spanners, hoisted on to a lorry, and dumped in a corner of a shed, presumably to be "written off". At least, so the Commanding Officer of that time (Squadron Commander Gregory) decreed. Unfortunately, or fortunately, Lieutenant Bone ordered the 'bus to be reconstructed for further service. She was a tangled mass of wires and fabric. However, the planes were stripped, fitted with new spars, fuselage re-covered, all new controls spliced. This machine was the only one of her type, fitted with warp control. She was erected and was "trued-up" by the aid of a very indistinct photograph which happened to be in the possession of the original owner. She was flown by Mr. Bone and was found tail-heavy. The tail-plane was removed and was replaced by a larger one, made from lengths of tubing for framework from a sketch chalked out on the workshop floor, and was again flown by Mr. Bone and passed into service. The credit for this job must be given to Chief Petty Officer Edwards for the confidence displayed in himself and his small staff, and to the officer, who was not afraid to test her.'

At the end of October Squadron Commander Gregory made a report to the Inspecting Captain of Aircraft on the work per-

formed at the air station from the start of hostilities to the end of October. Despite the shortage of personnel and aircraft (it will be remembered that 5 machines had been sent to Scapa Flow), over 122 hours had been flown on 'war coastal patrols'. Owing to the difficulty of getting spare parts, on an average only two machines were available for service at any given time during that period. In addition to flying, a large amount of other work had been done: four officers had been instructed in seaplane flying, recruits had been trained in the 'care and maintenance of aircraft', engines had been overhauled, machines had been rebuilt, and all had been busy with 'the fitting out of the station which was considerably delayed owing to the review at Spithead in July'.

All the machines in the Royal Naval Air Service up to this month (October) bore no mark to distinguish them from those of the enemy, but on October 26 the Admiralty Air Department instructed all commanding officers of naval air units that it had 'been decided that in future all aeroplanes and seaplanes of the Royal Naval Air Service shall carry a distinguishing mark in the shape of a Union Jack painted on the lower surface of each of the lower planes'. The size of this Jack was to be 'seven feet long by five feet wide', and it was said that 'the colouring of the flag should be bright, and it should be placed half-way between the fuselage and wing-tip'. This method of distinguishing aircraft was found to be unsatisfactory and was replaced in the next year by a mark consisting of concentric disks of red, white, and blue.

The air station was soon to have its first glimpse of war, for on November 3 an attack was made by a hostile fleet on this country, something that had not occurred for nearly 250 years, when, in 1667, De Ruyter had raided the shipping in the Thames estuary. Some time before November the Admiralty had been receiving reports that the enemy were contemplating activity in the North Sea, but they were vague, although it was believed that it would show itself in the southern area. In order to be able to combat this move, it was decided to make certain new dispositions with our cruiser and destroyer forces.

At 7.0 a.m. on the 3rd, the Commander-in-Chief of the Harwich Force (Commodore Sir Reginald Tyrwhitt) received a signal from the gunboat *Halcyon*, stating that she was being attacked by hostile ships off the Cross Sands light vessel, and a few moments later Great Yarmouth was shelled. The enemy battle cruisers *Seydlitz*, *Von der Tann*, and *Möltke*, the cruiser *Blücher*, and the three light cruisers *Kolberg*, *Graudenz*, and

Strassburg had appeared off the coast. These ships were capable of steaming some 28 knots and were heavily armed. The *Seydlitz* and *Möltke* carried ten 11-inch guns, the *Von der Tann* eight 11-inch, and the *Blücher* twelve 8·2-inch guns, and the light cruisers were powerfully armed ships, so that the *Halcyon*, with her speed of 19 knots and her armament of two 4·7-inch guns, was hopelessly outclassed, and it was remarkable that she escaped destruction.

According to Admiral Scheer, the object of the enemy on this enterprise was 'to force the enemy out of port'. They did not send a covering force 'because the plan was to be based entirely on surprise under cover of darkness'. These ships had left the Bight of Helgoland the night before and made the Cross Sands light vessel about dawn, the *Halcyon* being some 4 miles south of it. Near the latter, some 2 miles away, was the destroyer *Lively* (Lieutenant Baillie Grohman, R.N.), and, astern, another destroyer, the *Leopard* (Lieutenant V. S. Butler, R.N.), patrolling off the Scroby Sands buoy.

As soon as she sighted the leading ships of the enemy, the *Halcyon* challenged them, and in reply was fired on, the second salvo carrying away her wireless aerial. She thereupon turned about to the south-west, the *Lively* meanwhile steaming on a parallel course on her engaged side and setting up a funnel smoke screen between her and the enemy. So well was the *Halcyon* handled and protected that she was hit only eight times and suffered but superficial damage. Only three of her crew were wounded.

The enemy apparently took their range from the St. Nicholas light vessel, but she had had her moorings shifted recently, so that all their shells fell short of the town and into the sea, with the exception of one that passed over the air station and Gorleston, and failed to explode on impact in some fields beyond.

At the time there were no machines in service at the air station, because the solitary Maurice Farman 'Longhorn' was being overhauled, and all that the personnel could do is described in a letter written by one of the officers:

'We made our way, accompanied, incidentally, by the cheers of some 50 people who did not know we had no machines, off to the air station. By the time we got there the firing had ceased, but our trouble was rewarded by the sight of the *Halcyon* legging it for Lowestoft with half the crew sitting on the safety valves. Being a gunboat of very antiquated design, and not exactly an ocean greyhound, it was only by wonderful seamanship on

the part of the skipper that she was able to avoid being sunk. The rest of the day consisted in sitting about the air station telling each other what brave fellows we could have been if only we had had a machine to fly!'

As soon as the *Halcyon* was able to make a fuller report, energetic measures were taken to cut off the enemy's retreat and force him into action, although immediately the cruisers had opened fire the remaining destroyers at Great Yarmouth had proceeded to sea, but were too late to engage the enemy.<sup>1</sup> The three submarines which were there—*E. 10*, *D. 3*, and *D. 5*—put to sea immediately, but *D. 5* struck a floating mine (probably laid by the returning enemy, as fishermen reported seeing them laying mines) and sank with the loss of nearly all the crew.

In brief, the steps taken were that Commodore Tyrwhitt, with a force of light cruisers and destroyers, steamed from Harwich to a position near Terschelling to try to cut off the enemy's retreat, the nearest east coast defence patrols were ordered to the last known position of the enemy, and all available submarines at Harwich and Dover were instructed to proceed to sea. In case the enemy doubled back, Vice-Admiral Sir David Beatty, with his battle cruisers and a supporting screen of light cruisers from the Grand Fleet, steamed at a high speed for a position north of Helgoland. Battleships also took up positions north of the mouth of the Channel, but despite these dispositions, the enemy managed to elude our forces, although a cruiser with attendant destroyers chased the enemy; but they were recalled owing to the overwhelming strength of the latter. The enemy did not return without loss, as the cruiser *Yorck* struck a German mine off the Jade in a fog, and sank with the loss of some 300 of her crew.

Soon after this affair a supply of machines was sent to Great Yarmouth air station and patrols were once more started. One of the officers who was at the station at this period describes them as follows :

'From Yarmouth to Hunstanton and back, landing at the latter place for lunch and petrol. From Yarmouth to Cromer, then Yarmouth to Southwold and back. This was done non-stop. The patrols were carried out on land machines, i.e. Short "pusher" and Maurice Farman. They usually took just about 2 hours. The sole armament carried was a rifle which the passenger had across his knees. The object of the patrols was to keep an eye on shipping and investigate any strange craft seen, especially in the vicinity of Haisborough, where at one time it was thought the enemy might try

<sup>1</sup> For a detailed account of these operations vide *Naval Operations*, vol. i, chapter xviii, pp. 249-55.

a landing. Certain brave and hopeful people had a vague idea that they would meet a Zeppelin and, having nothing with which to shoot it down, would die a glorious death by diving into its midst! No anti-submarine patrols were started whilst I was there, that is, up till October.'

During the next few weeks after the bombardment, all hands were engaged in equipping all the machines with bomb-carrying and release gear. The only standard bomb-carriers in service at this period were the single 16-lb. bomb and the 20-lb. gear for two Hale 20-lb. bombs, both being of an elementary pattern.

On November 19 an act of gallantry was performed at the air station by Petty Officer Telegraphist Hendry, for he saved Flight Lieutenant Lan-Davies from death by drowning. At 8.0 a.m. while they were coming in to alight opposite the air station, and not wishing to do so with bombs on board (as their detonating gear was so unreliable), the pilot dropped his bombs into the sea so low down that the explosion of one bomb, on hitting the water, blew the tail off the machine (or at any rate wrecked the tail controls). The machine then dived into the sea and Hendry was thrown out. Lieutenant Lan-Davies was rendered unconscious by the impact, but Petty Officer Hendry swam to the wreckage and pulled him out of the seat, and supported and swam with his unconscious body in his arms until they were both rescued some time later by the drifter *Noreen*. For this gallant act Petty Officer Hendry was awarded the Albert Medal.

At the end of November Squadron Commander Gregory was appointed to the Central Air Office, Sheerness, and Flight Commander W. P. de Courcy Ireland took command of the air station. He had previously commanded the Naval Flying School at Eastchurch.

Towards the end of the year, owing to the limitations of aircraft wireless telegraphy apparatus, attention was devoted to the use of carrier pigeons for the conveying of messages, which were written on special thin paper, rolled up into the form of a tube, and this tube was inserted into an aluminium cylinder which was affixed to one of the legs of the bird. It is important to remember that the flying capabilities of these birds over distances are governed by the weather and by their physical condition, which varies with the season of the year. During the latter part of the moulting season, that is to say, from about the middle of August to the end of October, old birds are not capable of flying great distances. Furthermore, the weather from November to March is not very favourable to them finding their way in the air.

The first air station to be equipped with carrier pigeons was that at Westgate, and Great Yarmouth did not receive its quota till some time later.

For the rest of the year, owing to uniformly bad weather, to shortage of machines, and to trouble with those machines already on the station, virtually little flying was done from Great Yarmouth.

At the end of the year there were 4 officers at the air station and about 60 ratings. The commanding officer was Flight Commander W. P. de Courcy Ireland, and the other officers were Flight Lieutenants J. M. R. Cripps, F. M. Barr, and Flight Sub-Lieutenant Lan-Davies.

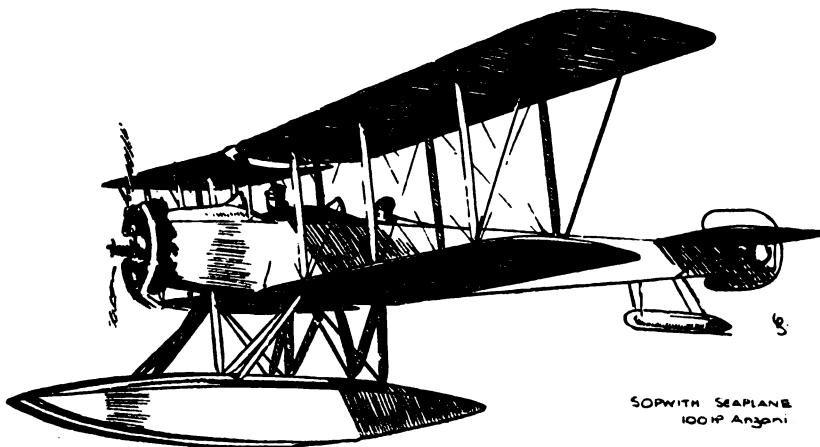
From August till the end of 1914 few types of new machines were issued to the Royal Naval Air Service; the paramount task of the authorities was to lay the foundations for the huge supply which it was realized would be needed in the future. This applied not only to aeroplanes, seaplanes, and airships, but to engines, magnetos, instruments, and indeed all aircraft accessories. Add to these requirements machine-guns, mountings, sights, bombs, bomb-release gears, flares, and the like, and it will be realized how enormous the task of supply was—especially with the Navy and Army each clamouring for huge and ever-increasing quantities of munitions of war—all this in the face of a powerful and superior-equipped enemy.

The shortage of engines was the limiting factor in the supply of aircraft, and had it not been for the help that the French engine industry gave us, we could have put few machines in the field in the early months of the War.

A few days after the outbreak of hostilities the Daimler Engine Company came to an arrangement with the builders of the Gnome engine (*Société des Moteurs Gnome*, Paris), whereby the former were granted a licence to build the Gnome engine. The Daimler Engine Company completed its first engine of this type (one of 80 b.h.p.) by September 30 (1914), no mean feat, considering the number of new drawings (over 1,100), tools, jigs, and gauges that had to be made. The same firm also undertook the manufacture of the 90 b.h.p. air-cooled engine designed by the Royal Aircraft Factory. Other firms which concentrated on the production of aircraft engines were Rolls Royce & Company, Ltd., Sunbeam Motor Car Company, Ltd., William Beardmore & Company, Ltd., and the Green Engine Company, Ltd.

Allied with the shortage of engines was the collateral lack of magnetos. Before the War approximately 300,000 magnetos were imported into Great Britain, and of these about 90 per cent. were supplied by the German firm Bosch. There was only one firm of magneto makers in this country—Thompson Bennett & Company, Ltd., of Birmingham—whose yearly output was about 1,000. We had to subsist (not only the Air Services but the Navy and Army as well) in 1914 and 1915 on the magnetos we could get from America and the stock of those of German manufacture in the country. The position with regard to sparking-plugs was similar. In August 1914 the three British firms had a total yearly output of only 5,000 ; in October 1914 we produced only 420 sparking-plugs.

The same story can be told of all other aircraft accessories, indeed of most of the required munitions of war; but despite all these difficulties the number of aircraft increased, and by the end of 1914, amongst the machines that pilots in the Royal Naval Air Service were flying were Henri Farman, Maurice Farman (70/80 b.h.p. Gnome), Avro (80 b.h.p. Gnome), Bristol (80 b.h.p.), Morane-Saulnier monoplane (80 b.h.p. Gnome), Sopwith 'Tabloid' biplane (80 b.h.p. Gnome), Grahame-White 'Boxkite' biplane (80 b.h.p. Gnome). The seaplanes were those built to the designs of the firms Short, Sopwith, and Wight.



## VIII

### THE ACTIVITIES DURING 1914 OF THE GERMAN AIR STATIONS OPPOSED TO GREAT YARMOUTH AIR STATION

THE German air stations that were opposed to Great Yarmouth air station were those at Borkum, Norderney, and Zeebrugge. The first of these stations was commissioned on August 1, 1914, and Kapitänleutnant Bertram assumed the command ten days later with 36 men and 2 machines, all the stores and machines being brought to the site by the torpedo boat *D. 4*. On September 18 (1914) an abnormally high tide wrecked the temporary wooden shed that had been erected, and with it the two machines. After this set-back the personnel were housed in tents and two more machines were sent, and arrangements were made (in December) to build a 'massive shed to hold 12 seaplanes of the type then existing' on Borkum Roadstead, as the first selected site was found to be unsuitable, but this shed was not finished until June 1915. A crane capable of lifting 2½ tons was erected, and the machines were lifted by it from the quayside and deposited into the water.

The duties of this air station were outlined by the German Admiralty as follows:

- (a) Reconnaissance over the western section of Helgoland Bight.
- (b) Protection of mine-sweepers and scouting vessels.
- (c) Protecting shipping in the neutral channel from 53° N. and 3° 55' E. to 53° 54' N. and 3° 55' E.
- (d) Defence against enemy aircraft.'

Owing to the difficulties experienced in establishing the station, coupled with the fact that there were never more than two machines on it during the year, pilots made only six 'war flights' from it during 1914, and on these occasions they generally sighted English naval forces.

On Christmas Day (1914) the Harwich Light Forces, together with the seaplane-carriers *Engadine* and *Riviera*, raided Helgoland Bight in order that the seaplanes from the carriers might bomb the airship sheds at Cuxhaven.<sup>1</sup> The sheds were not located, but the German naval ports were surveyed very

<sup>1</sup> Vide *The War in the Air*, vol. i, pp. 402-5.

thoroughly, and a good deal of damage was done by the bombs the seaplanes dropped. Machines from Borkum air station attacked with bombs some of our ships, but did not hit them. A midshipman, by name Herzfeld, and a mate—Puschmann—were commended by the German naval authorities for the bravery they had shown during this attack.

The air station at Norderney was commissioned on August 29 (1914) under the command of Oberleutnant Otte, and was intended at first 'to serve as a shelter for Borkum machines as there was not enough room there . . . it was subordinate in every way to the naval air station at Borkum'. In August 'an aeroplane tent with a slipway was built on the sandbank to the east of the harbour channel, and stores laid down near it', but the same tide that wrecked, on September 18, the station at Borkum wrecked both the shed and slipway at Norderney, so that a new shed had to be built, with the result that during 1914 no machines were sent to this station, and in consequence no flying was done from it.

Zeebrugge seaplane station was founded on December 6, 1914, 'on the bleak mole'—the railway station shed being converted into a hangar. The commanding officer was Oberleutnant zur See von Arnould de la Perrière, and with him were two flying officers, one ground officer, 55 men, and two 120 b.h.p. Friedrichshafen seaplanes. The officers were at first housed in the Palace Hotel and the men in billets, but later the captured steamer of the Great Eastern Railway Co., Ltd., S.S. *Brussels*, was converted into quarters for all. By the end of the year there were four machines on the air station with which 26 'war flights' had been made. The duties of this air station were:

- (a) Reconnaissance, both coastal and deep sea, in the English Channel, and off the coasts of France, England, and Holland.
- (b) Protecting shipping in these waters.
- (c) Protection of cruiser and destroyer flotillas and submarines.
- (d) Fighting patrols in these waters.
- (e) Co-operation with the naval forces in attacks made on the enemy.
- (f) Spotting for coastal batteries.
- (g) Bombing raids.'

One distinguished officer of the German Naval Air Service has contributed the following note on the activities of the above air stations during 1914:

'The duties of all air stations on the North Sea consisted, at the beginning of the War, solely in reconnaissance, and in fighting submarines, so far as the poor machines and the very inferior bombs permitted. The air stations

were all under the Commander of the Second Seaplane Division, who had his head-quarters at Wilhelmshaven, and were under the orders of the Commander of the Scouting Ships, Admiral Hippe. Normally, Borkum had to scout to the west, Norderney to the north-west, Helgoland to the north-west, and Lyst to west and north. This scouting extended to 100-120 nautical miles in the appointed direction, which was equal to a flight duration of 4 hours. Owing to the lack of aircraft, the machines always had to fly singly in 1914-15, and, as wireless telegraphy was not yet sufficiently developed, the result was that the machines, when they sighted the enemy's forces, were compelled to fly back to their station to report verbally. Owing to this, the value of the intelligence was, of course, greatly diminished. Also, in cases of engine breakdown, the lack of wireless telegraphy was a source of great danger to the aircraft, because no one knew where they had alighted, and in this way a great number of machines disappeared altogether.

'In the year 1914 and at the beginning of 1915 only the unarmoured Friedrichshafen seaplane with 100 b.h.p. Mercedes engine and wireless was used with 50 kilo. bombs. . . . In the year 1914 there were on an average 2-3 machines with the necessary crews at each air station.

'When war broke out there were 6 machines and 6 officers at the air station at Helgoland, the only one then in existence. On August 28, 1914,<sup>1</sup> the day of the raid by the English cruisers in Helgoland Bight, there were only two serviceable machines in Helgoland. They started, saw a part of the light forces, but could not obtain a connected picture, as they mostly had to fly at a height of about 20 m., on account of the very bad visibility, and on their return did not find the Island of Helgoland, so that their reports reached the Naval Command much too late to be of use.

'The Commander of the Helgoland air station at that time was Kapitän-leutnant Berthold. The Borkum and Lyst air stations were commissioned in August 1914, but only with temporary sheds. In October of the same year the Second Seaplane Division, under which all the North Sea air stations were placed, was created. In the month of October English forces were often seen and reported from Borkum, also on October 24 from Helgoland. These reports were, however, not made use of by the Fleet Command, especially as they generally reached the command too late, because of the lack of wireless telegraphy in the machines. In October and November submarines were frequently attacked, and the pilot of a Helgoland machine asserted that he had achieved an undoubted success. At the end of November a flotilla of cruisers was bombed and one hit noted. On December 25, 1914, the attack by English machines on the airship sheds at Nordholz took place. The co-operation of the English machines engaged with the submarines seems to have been well prepared, for all English pilots were picked up by their submarines and we only succeeded in taking one Avro back to Wilhelmshaven. The seaplane-carrier, escorted by cruisers, which stood to the north-north-west of Helgoland, was bombed. For the

<sup>1</sup> This remark refers to the naval action in which a British squadron sank the German light cruisers *Köln*, *Mainz*, and *Ariadne*.

first time defence by means of anti-aircraft guns made an appearance. In this action Kapitänleutnant Berthold's machine received a direct hit through the wing, which damaged it so much that, though she was able to remain in the air, on landing in Helgoland harbour she collapsed entirely.'

The German Naval Air Service encountered the same technical difficulties as we did in the first year of the War. These have been outlined by one of its officers, who subsequently stated that:

'The performance of our seaplanes was first confined by their limited petrol capacity to a radius of action of 75 nautical miles, and therefore to a total flying limit of 150 nautical miles. As they carried no wireless they could only communicate information to the ships at sea by means of signalling lamps. These machines were not strong and consequently were unable to stand against bad weather. In spite of that fact, air pilots, fired by the spirit of war, frequently undertook flights which did much to improve the general efficiency, and thanks to the excellence of the engines, tended greatly to strengthen the faith of the pilots in their machines. The once desultory research was now pushed forward with every means at our disposal, but it was a hard task. Practical design was in an embryonic form, the number of flying officers was small, and furthermore, at the beginning of the War, the military authorities took control of the aero-engine factories. The Navy was, therefore, compelled to adapt the Army aero-engine to its seaplanes. Consequently the chance of producing a powerful engine, which is of paramount importance to the seaplane, was temporarily lost. . . . On account of the demand for aeroplanes, many machines had to be made use of in the first few months of the War which suffered from serious defects—defects which, although quickly discerned and corrected by the designers, could only be remedied in the machines on active service by laborious research on the part of the flying officers themselves. . . . Only 100 h.p. reconnaissance machines were available for the early operations of the War. These machines were two-seaters, and carried enough petrol for 4 hours' flying.'<sup>1</sup>

As the aerial bomb was to play such a prominent part in air operations, it is interesting to note that the earliest types designed by the Germans were so ineffective that as early as the spring of 1914 they were replaced by bombs of a type known as 'Carbonite'. These bombs, which were used throughout the early period of the War, were pear-shaped and solid, pointed, and had a propeller-actuated pistol. Their special characteristic was the form of air-drag used; instead of fins a sort of inverted tin cap was used, attached to the tail of the bomb by stays. The smallest of these bombs weighed 4·5 kg. (about 10 lb.) and the heaviest 50 kg. (about 110 lb.). Small incendiary bombs of the carbonite type were also used. There was, further, a grenade-like projectile

<sup>1</sup> Vide *Die deutschen Luftstreitkräfte im Weltkriege*, p. 61. (English edition.)

thrown by hand, which weighed 800 grammes (1.75 lb.), but this was criticized as being too small to be effective, as also was the 4.5 kg. high-explosive 'Carbonite' bomb.

In short, it may be said that for both combatants the year 1914 was one of tentative experiment and some realization (although limited in extent) of the tasks before both, if victory was to be secured for one or the other.

## IX

### THE ACTIVITIES OF GREAT YARMOUTH AIR STATION DURING THE YEAR 1915

IT had been a matter of surprise to the authorities that Germany had not made airship raids on this country during 1914, for, at the outbreak of hostilities, it was thought that she might use her Zeppelin airships for this purpose.

Although Germany had 10 rigid airships at the opening of the War, these resources soon vanished. Employed on daylight reconnaissance, both on the eastern and western fronts, 4 army airships were shot down by gunfire from the ground, while others were destroyed by accident, and the military service were incapable, at an early date, of offensive action against this country. Apart from this, it was felt that for success to attend such raids, due to the limited radius of the airships, they must operate from Belgium, and in 1914 the sheds for their housing in that country were not ready.

As early as September (1914) the Naval Staff and Imperial Naval Board had discussed attacks by naval airships on England, but, as only one such airship was in commission (*L. 3*), it was recognized that such operations would be foolish at that stage, and it was decided to postpone action until more airships were available.

In pursuance of this policy, the German authorities started to erect sheds in Schleswig-Holstein and Hanover, and to establish a chain of meteorological stations along the coast from Ostende to Königsberg (East Prussia). The naval authorities also asked for the allocation of 4 new airships, and this request started what is believed to have been a somewhat bitter struggle between themselves and the army authorities for the possession of these airships. The Navy won, and by December it had 5 airships, but was unable to agree with the Army as to the methods of co-operation in attack; moreover, the Imperial Chancellor (von Bethmann-Hollweg) would not permit London to be included amongst the places to be bombed.

With respect to the exclusion of London it should be remembered that The Hague Declaration of 1899 (which was signed by all the leading Powers) definitely prohibited any kind of bombing

by aircraft. When it is remembered that the first power-driven aeroplane had not flown at that time, it will be realized that the Declaration was of little value. Eight years later (1907) the matter was again discussed at The Hague, and, arising out of further deliberations, belligerents were forbidden to bomb 'undefended towns'. Unfortunately, however, those responsible for this statement failed to specify what constituted a 'defended town'. Anyhow, its vagueness was not important, for the Declaration was only ratified by four Powers: Great Britain, the United States of America, Belgium, and Portugal. It is, therefore, important to remember that by bombing towns from the air Germany did not break any legal obligation. Whether she broke a moral one is not a matter to be discussed at length in this narrative, for any discussion to be of value must define and differentiate between a combatant and a non-combatant—by no means an easy task and one outside the scope of this work.

Turning now to our aerial defence arrangements in operation at the outbreak of hostilities, it may be remembered that it was stated in the first chapter of this story that for several years previous to the commencement of the War those in authority had been in no way blind to the menace of hostile aircraft attack, and had made plans to combat it. Experiments had been made with 'high-angle-fire' guns, and with searchlights capable of operating with the beam in the vertical position. The danger, on the occasion of such attacks, of brilliantly lighted towns had been realized, and, in the event of an attack by night, it had been proposed that all dockyard lights and lights of towns should, as soon as possible, be turned off when warning came that hostile aircraft were expected. In cases where a naval air station was close to a point of military importance, it was arranged that naval aeroplanes would be available for defence. In general, however, it may be said that before the War the War Office claimed all responsibility for anti-aircraft home defence, and so any duties undertaken by the Navy were additional to the efforts that might be made by the former.

After some discussion the Admiralty, at the request of Lord Kitchener, undertook, on September 3, 1914, the aerial defence of the country, chiefly because the Royal Naval Air Service had more aeroplanes available than the Royal Flying Corps. When the Admiralty assumed this duty, it stated that, owing to the large area involved, it would be impossible to defend the country against aerial attack merely by artillery, for, in the words of the First Lord (Mr. Winston Churchill), made during a speech in

the House of Commons, 'after all, the great defence against aerial menace is to attack the enemy's aircraft as near as possible to their point of departure', and this was the policy that governed the operations of the Royal Naval Air Service against hostile aircraft. A considerable measure of success attended it, for, through the efforts of naval pilots, on October 8, 1914 (after an abortive attempt the previous month), the airship shed at Düsseldorf was destroyed, together with an airship housed in it; on November 21 the works of *Luftschiffbau Zeppelin G.m.b.H.* at Friedrichshafen were bombed and an airship was damaged, and on Christmas Day an abortive attack was made on the airship sheds at Cuxhaven.

According to *The German Air Raids on Great Britain, 1914-1918*,<sup>1</sup> there were, at the time the Admiralty assumed responsibility for the aerial defence of the United Kingdom (September 3, 1914), 33 anti-aircraft guns available, of which three 1-pounder 'pom-poms' were intended for the inner defence of London. These were placed near the Admiralty, Foreign Office, and the office of the Crown Agents. The Royal Arsenal at Woolwich also had two of these guns. The other 28 guns, consisting of 3-inch and 4-inch Q.F. guns and 'pom-poms', were mounted at points which were considered to be of naval importance. There were also a certain number of searchlights.

In order to man these weapons, a special branch of the Royal Naval Volunteer Reserve, known as the 'Anti-aircraft Corps of the Royal Naval Air Service', was formed, and this body was at first responsible for manning the guns and searchlights in London.

Measures were taken also for the co-ordination of the naval and military air Services. The primary duty of the aeroplanes of the Royal Flying Corps was to assist the Army in opposing any attempt by the enemy to land troops in this country. Any machines which were not required for this purpose were to act in conjunction with those of the Royal Naval Air Service for anti-aircraft defence. The Admiralty was to be solely responsible for the aerial protection of London, and for the time being the machines of the Royal Flying Corps which were stationed at Hounslow and Joyce Green were to give it assistance until such time as the naval squadrons were ready to do so. The Admiralty was also to provide aircraft for the defence of ports and for the attack of any enemy machines which had crossed the coast, but again the War Office was to assist whenever possible. Anti-

<sup>1</sup> Pp. 12-15.

aircraft guns for London and other large cities were to be manned by the Navy, and the Army was to be responsible for the defended ports and places of military value. Flights were made to test the visibility from the air of London by night-time, and orders were issued for restricted lighting on October 1, 1914. The police, within a radius of 60 miles, were instructed to warn the civic authorities when it was known that hostile aircraft were approaching the city. Towards the end of the year (1914) the area of the London anti-aircraft defences was extended so that it was encompassed by a circle of a radius of six miles with Charing Cross as its centre. The armament for the protection of this area had been increased to two 3-inch 20 cwt., four 6-pounders, six 1-pounder 'pom-pom' guns, 12 searchlights, and a volunteer corps of about 1,000 strong to serve them.

Towards the end of the year information was received that the German authorities were contemplating many airship raids on this country in the near future, and, in addition to the above-mentioned steps, five look-out posts were established on the east and south-east coasts between Folkestone and Shoeburyness. Not that there had been no alarms, for at the beginning of September circumstantial reports were received to the effect that a hostile airship was believed to be harbouring in the Cumberland and Westmorland hills, and that it was patrolling the country by night; but these reports were found, as might be expected, to have no truth in them.

The duty of the fighting force at Great Yarmouth air station was to attack all hostile airships that appeared in the 'operation area' assigned to it. During hostilities pilots from this air station were responsible for the destruction of a greater number of enemy airships than any other unit of the Allied Forces.

Although the German air services made no airship raids on this country until 1915, they did make two aeroplane raids in the first year of the War—on December 24 and 25. The first was made on Dover, and the second over the mouth of the Thames, as far up as Erith. A total of 3 bombs was dropped during these two raids, but no casualties or damage were inflicted.

While Zeppelin airships had not raided this country before January 1915, it must not be thought that they had not been usefully employed in other capacities, for this is far from the case. They had made many reconnaissance flights over the North Sea, and they took part in the action of December 25 (1914)—the day of the Cuxhaven raid.

Raids cannot be made unless the ground organization is sound, and the sheds for the reception of the naval airships were not ready until the end of 1914. These were at Nordholz (near Cuxhaven) and at Fuhlsbüttel on the Elbe, just north of Hamburg. The first of these sheds was built for the Imperial German Naval Airship Service and was of the double revolving type, so constructed as to enable the airships housed within it to be brought out 'head to wind' no matter which way the wind was blowing. The shed at Fuhlsbüttel belonged to *Hamburger Luftschiffhafen G.m.b.H.*—a private airship company—but it was taken over by the Navy at the outbreak of war.

By the beginning of 1915 the airships and ground organization were sufficiently developed for the German General Staff to decide that airship raids should be made on this country. The Emperor (after, apparently, a good deal of reluctance) gave permission, on January 9, 1915, for such operations, but he stated that they were to be 'expressly restricted to military shipyards, arsenals, docks, and, in general, military establishments, and that London itself was not to be bombed'.<sup>1</sup>

In pursuance of this policy, on January 19 (1915) this country was attacked by 3 naval Zeppelin airships—*L. 3*, *L. 4*, and *L. 6*. The raid was organized by the commander of the Naval Airship Service, Korvettenkapitän Peter Strasser, and the 3 airships were commanded by Kapitänleutnants Fritz, Graf von Platen-Hallermund, and Oberleutnant Freiherr von Buttler respectively.

The airships started for this raid on the morning of the 19th, *L. 3* and *L. 4* from the shed at Fuhlsbüttel and *L. 6* from Nordholz.

When half-way across the North Sea *L. 6* (Oberleutnant Freiherr von Buttler) developed engine trouble and turned about for Germany; the others pressed on. The airship *L. 3* (Kapitänleutnant Fritz) made her 'landfall' off Ingham (about 15 miles north by east of Great Yarmouth), and passed over the latter place at about 8.20 p.m. Fritz dropped 9 bombs, with the result that an aged couple were killed and some cottages demolished. He then went out to sea, passed over the Corton light vessel, proceeded up the coast between the Cockle and Newarp light vessels, and, at about 10.0 p.m. was abreast of Cromer. *L. 3* then stood about to the north-east, and her commander afterwards took her back to Fuhlsbüttel.

Kapitänleutnant Graf von Platen-Hallermund of *L. 4* made his

<sup>1</sup> *Der Krieg zur See, 1914-1918*, vol. iii, p. 182.

'landfall' at about 8.0 p.m. just south of Mundesley (a village about 5 miles south of Cromer). He then proceeded up the coast to Sheringham, which he encircled, dropped a bomb on the eastern outskirts of the town, and then turned out to sea, and at 10.0 p.m. *L. 4* came over Hunstanton, outside which place her commander caused 3 bombs to be dropped. From there Platen-Hallermund made a winding course till he came over King's Lynn, upon which he dropped 4 bombs, killing a man and a woman and injuring 13 people. *L. 4* then proceeded across Norfolk, went just north of Norwich, and passed over Great Yarmouth just after midnight, on her way out to sea and to Fuhlsbüttel.

Between £7,000 and £8,000 worth of damage was caused by the explosion of all the bombs dropped during the whole of this raid.<sup>1</sup>

Although there were 3 machines ready at Great Yarmouth air station, they did not attack either airship as these 'had been lost from view'. Even if this had not been the case the 3 machines could not have done the airships any harm, as they were incapable of reaching anything like the heights that were possible to the airships, nor were they armed with any weapons, other than a rifle in the hands of the pilot. Not a single round was fired from any gun at these airships during the whole course of this raid.

As a result of this raid the anti-aircraft defences of East Anglia were strengthened by the addition of some motor-cars equipped with machine-guns on 'high-angle mountings' together with some searchlights also mounted on cars. It was hoped by the aid of these devices to engage hostile airships which succeeded in evading fixed guns. This mobile section was based on Newmarket, and had as its field of action all Norfolk and Suffolk.

That certain Zeppelin airship commanders did not approve of this raid—as being premature—may be gathered from the following remarks made by one of them, who has since said that 'looking at that first raid from the German point of view, I have always maintained that this premature isolated raid was a most foolish mistake. It served no reasonable purpose, and since it could not be followed up for more than 3 months, it simply betrayed our hand. The enemy had time to prepare a sort of defence, thus making it more difficult for later attacks.'<sup>2</sup>

It is interesting to note that the town of Great Yarmouth was attacked on the occasions of the first and last airship raids made

<sup>1</sup> For further details of this raid vide *The German Air Raids on Great Britain, 1914-1918*, pp. 17-20.

<sup>2</sup> *The Zeppelins*, p. 104.

on this country during the War, and that Strasser led the raiders both times; on the last raid (August 5/6, 1918) this officer met his death at the hands of pilots from the air station.

To return to the activities of Great Yarmouth air station, the weather during January and February was too bad to allow of much flying, and during these two months the work done on the station cannot be better described than by quoting the laconic phrase from the 'Daily Report': 'Hands employed in care and maintenance of machines and station as required', and of what this work consisted may be seen from the following typical report:

'Hands employed on repairs to seaplane 126 (Short 160 b.h.p. Gnome), aeroplane 1053 (Sopwith 80 b.h.p. Gnome), and erecting aeroplane 1368 (Henri Farman 80 b.h.p. Gnome). Erectors from Sopwiths erecting machines 1057 and 1058 (Sopwith 80 b.h.p. Gnome). Erectors from Aircraft Company truing up aeroplane 1368 (Henri Farman 80 b.h.p. Gnome). Assembling engines of 126 (Short seaplane 160 b.h.p. Gnome) and 1053 (Sopwith 80 b.h.p. Gnome). Care and maintenance of station as requisite. Air mechanics instructed in anti-aircraft armament and duties as passenger. Squadron Commander Spenser Grey arrived from Dover to superintend installation of Holt Flares.<sup>1</sup> Strong southerly gale.'

At the beginning of March Sub-Lieutenants Vincent Nicholl and Chichester H. Smith joined the station. Sub-Lieutenant Nicholl was one of the original six Probationary Flight Sub-Lieutenants who had joined the Royal Naval Air Service within a week of the outbreak of hostilities. He received his preliminary flying training at the school of the Eastbourne Aviation Company. As an undergraduate at Cambridge he had been keenly interested in flying, and along with three friends (Maurice Wright, F. G. T. Dawson, and Kenneth Wanklyn) made 'a gallant, if not highly successful, effort to impress on that University the benefits of flying'. They all four spent much of their time before the War in gliding experiments at Eastchurch, work in which they were aided by Mr. Alec Ogilvie, and as a result of this they entered the Service with much practical knowledge, and thereafter served the King with distinction.<sup>2</sup>

<sup>1</sup> These flares were the invention of Lieutenant-Colonel H. S. Holt, and were used for the illumination of the ground beneath the machine while landing at night. They were affixed to the underside of the lower planes near the wing-tips and the compound inside them was fired electrically.

<sup>2</sup> Vide *The Aeroplane* and *Flight*, both of October 27, 1927, for a biography of this officer.

More armament was now becoming available, and towards the end of March a Lewis gun was mounted on the top of one of the sheds, thus giving the station its first fixed anti-aircraft defence. A month or so later a 6-pounder gun was mounted outside the station for the same purpose. Contemporarily with this the roofs and sides of the sheds were camouflaged, and on their fronts woods and ranges of hills were painted. The result of these efforts in paint may best be described by quoting the words of Maurice Baring, who, speaking of similar efforts in France, said, 'We saw sheds beautifully *camouflés* but beautifully visible also.'

Experiments also were made during this month and April with the fitting of a 6-pounder Davis gun on Short seaplane No. 126. This gun, which weighed only 180 lb., was an ingenious weapon where the shock of its recoil was absorbed by the discharge, in the opposite direction, of a mass of small shot equal in weight to the projectile. The gun was double-ended, the breech-block being in the middle of the barrel. The trials, in so far as they went, were successful, but although large numbers of this gun were manufactured, it never came into general use in the Air Services.

Whenever the weather allowed, patrols were made during the early spring, but in addition to these a large amount of ground-work was done, for the effectiveness of any air station or squadron as a whole depends largely upon the efficiency of its ground organization.

On the night of April 15, naval Zeppelin airships, led by Korvettenkapitän Strasser, made another airship raid on this country. The airships were *L. 5* (Kapitänleutnant Böcker), *L. 6* (Oberleutnant Freiherr von Buttlar), and *L. 7* (Oberleutnant Petersen) with Korvettenkapitän Strasser aboard. These airships appeared off the coast of Norfolk and Suffolk, although it is believed that the original intention of Strasser was to bomb the defences in the Humber. Both *L. 5* and *L. 6* were hit by rifle fire. From the former airship no bombs were dropped, but from the latter 4 high-explosive and 30 incendiary ones were released over Maldon and Heybridge, near Chelmsford, with the result that a girl was injured and a house damaged. The airship *L. 5* (Kapitänleutnant Böcker) dropped 47 bombs in the neighbourhood of Lowestoft and Southwold, and although property was damaged there was no injury or loss to human life.<sup>1</sup>

The air station received the 'air raid warning' just before 1.0

<sup>1</sup> *R.F.C. H.Q., 1914-1918*, p. 161.

<sup>2</sup> Vide also *The German Air Raids on Great Britain, 1914-1918*, pp. 21-3.

a.m., and Flight Commander de Courcy Ireland left immediately with Leading Mechanic Notley in a Sopwith machine. Although this machine was in the air for nearly an hour, none of the airships was sighted. At 4.30 a.m. Flight Sub-Lieutenant Nicholl with Petty Officer Lytton left in another Sopwith machine and remained in the air for some considerable time, but, owing to the poor visibility, they too were unable to sight the enemy. Another pilot also tried to find them, but damaged his seaplane on a sand-bank while taxi-ing.

During the previous months the German military authorities had been establishing airship bases in Belgium, and Zeppelin airships under the control of the Army had made some night flights over the lines in France and Belgium. It was realized at home that the presence of airship sheds close to this country was a menace, and it was decided to try and damage them by means of bombs. The first attack was made by an officer of the Royal Flying Corps—Lieutenant L. G. Hawker—who, in a B.E. 2c, bombed the sheds at Gontrode on April 18. These sheds were vacated a few months later owing to the success of the attacks made by pilots of the Royal Naval Air Service, and subsequently were used only as emergency landing-grounds—the airships being housed on the western frontier of Germany. It is only fair to state that by then the technical improvement of the airships, with their increased range of action, rendered it unnecessary for them to operate from the sheds in Belgium.

The first raid made by an Army airship was made on the night of April 29/30. She made her 'landfall' a few moments before midnight off Felixstowe, in bright moonlight. Her commander dropped bombs on Ipswich, then came over Bury St. Edmunds, where more bombs (chiefly incendiary) were released, then ran into fog and later left the coast at Aldeburgh. Although 76 bombs were dropped very little damage was done, and there were no casualties. From Great Yarmouth, Flight Commander de Courcy Ireland, Flight Lieutenants Nicholl, Barr, and Smith flew off to search for her, but failed to sight her, largely on account of the mist.

It was known that the Zeppelin airship commanders liked to make a 'landfall' just before dark, and it was thought, therefore, that if fast seaplanes could be sent to a position 50 or 60 miles east of the English coast they would be able to waylay the airships during daylight, and so be in a good position to attack them. It had already become evident how extremely difficult it was to

locate airships at night-time in the areas patrolled by machines from Great Yarmouth, so in the early days of May an armed steam trawler—H.M.S. *Kingfisher*—was equipped for carrying a seaplane, and thereafter, in this little seaplane-carrier, certain officers from Great Yarmouth air station used to spend weeks at sea, patrolling to a position about  $4^{\circ} 8'$  east, that is, in the vicinity of the Haaks light vessel.

Although seaplanes were sent off from this trawler and her sister ships on almost every calm night during 1915, 1916, and 1917, the pilot of no such machine ever sighted a Zeppelin airship, although during this time a large number of raids was made on England by airships which must have crossed close to the patrolling seaplanes.

Ordinary trawlers were used for this work during 1915. In 1916, however, the Admiralty took over two paddle-steamer ferry boats—the *Brocklesbury* and the *Killingholme*. These it converted, so that they could carry on their decks two Sopwith seaplanes.

One advantage of these ships was their shallow draught, which gave them considerable immunity from torpedo attack and made them less liable to strike mines, for their draught was between 5 and 6 feet, as against the 17 feet of the *Kingfisher* or the *Cantrice*; nevertheless, the *Killingholme*, in the end, was sunk by a torpedo. The paddle-steamers had the disadvantage of being of somewhat light construction, as they were never designed for deep-sea work.

The routine followed by these ships was for the crew to launch the seaplane about an hour before dusk, the pilot then patrolling an area of about 10 or 15 miles radius from the ship. If he did not sight the enemy he would alight just before dark and the seaplane was then hoisted inboard. If an airship raid had been made on England the seaplane was hoisted outboard at dawn, and the pilot would then keep a good look-out for the returning enemy.

The question has often been asked why it was that, with as many as four of these small seaplane-carriers dotted about the North Sea, the pilots of the machines they carried never had an opportunity of chasing and destroying a hostile airship. It was certainly not due to lack of keenness on the part of either the pilots of the seaplanes or the captain of the ships, for all were chosen for this work because of their zeal. The captain of the *Kingfisher* (Lieutenant Curzon) was noted for his complete disregard for danger, for he would take his little trawler, armed only

with a 12-pounder gun, together with his escorting drifter, which was even more lightly armed, to beyond the Haaks light vessel, right into the enemy's waters. He would always try, not only to place his ship so that the seaplane pilot would be in a favourable position to attack enemy airships, but also in a position which would enable the pilot to make the Dutch coast, should he fail to find the trawler after the chase. The failure to achieve success could only have been due to ill luck on the part of the pilots and to bad visibility.

There are very few days in the North Sea when there are no patches of fog or of cloud in which an airship, wishing to do so, can easily hide herself. Should the visibility be good, it was probably easier for the crew of the Zeppelin airships to sight these seaplane-carriers than vice versa. Furthermore, there is little doubt that these ships, with the seaplane hanging over their side, were seen by enemy submarines, who reported their presence to their bases.

No attempt was made to fly these seaplanes at night-time when the trawlers were at sea as it was too dangerous, but several times they alighted with the aid of flares along the beach near the air station. On many occasions Zeppelin airships were heard during the night from these seaplane-carriers, when they were at sea, and fire was opened from the guns on board.

To return to the subject of enemy airship raids and the part played by the personnel of Great Yarmouth air station, in the early hours of the morning of May 10 a military airship, *L.Z. 38* (Hauptmann Linnarz), appeared off the estuary of the Thames and dropped 124 bombs (mostly of the incendiary type) on Southend, some of which nearly hit a hulk—the *Royal Edward*—in which a number of German prisoners was housed. As soon as Great Yarmouth air station was informed that this raid was in progress, Flight Lieutenant Nicholl went off in a Sopwith machine to try and attack the hostile craft, but he was, unfortunately, forced to land some 3 hours later owing to a broken lubricating oil-pipe in his engine. In addition, Flight Lieutenant Chichester Smith made a long patrol in the neighbourhood of Colchester. Altogether 11 machines rose to the attack from various air stations, but all their pilots failed to sight this airship.

It appears desirable at this stage when raids by military airships are being considered to draw attention to their nomenclature. *Luftschiffbau Zeppelin G.m.b.H.* gave the airships built by them works' numbers in a consecutive series, with the letters *L.Z.*

(*Luftschiff Zeppelin*) prefixed. When an airship was taken over by the Imperial German Navy she received a new titular number, prefixed by the letter *L*. (*Luftschiff*). For example, *L. 1*—the first of the naval airships—was *L.Z. 14* in the makers' enumeration. In a similar way every airship delivered to the Army was given a new number, prefixed by the letter *Z*. Before the War, when a military airship was destroyed it was replaced by a new one bearing the old number, but after the outbreak of hostilities this practice was discontinued. In November 1914 the *Z* series had been completed to *Z. XII*. The Army then abandoned this system of enumeration and retained the makers' works' number; thus the airship which would normally have been *Z. XIII* became *L.Z. 33*. In a similar way *L.Z. 35, 37, 38*, and *39* all retained their works' numbers as titular numbers. The airships with the intermediate numbers, namely, *L.Z. 34* and *36*, were allocated to the Navy and became *L. 8* and *L. 9*. This system was in vogue until the introduction of the standardized *L. 10* type in the May of this year (1915). The first naval airship of this type was *L. 10* (*L.Z. 40*), and the first standardized military airship was *L.Z. 72*, the number of which was obtained by adding the number *30* to the works' number. From that date all military airships continued (until the disbandment of the Military Airship Service in 1917) to bear numbers based on this principle, whereas the Navy adhered to the original scheme of enumeration, leaving out certain intermediate numbers. The omission of numbers generally marked the inauguration of a new type.

Day by day it became evident by reason of these continued raids that if Great Yarmouth was to offer effective resistance the station must have in its neighbourhood a number of emergency landing-grounds available for use at all times, day and night, and so the neighbourhood was examined for suitable sites. The first one chosen was at Bacton, but, later, others at Aldeburgh, Burgh Castle, Covehithe, Holt, Narborough, and Sedgeford were commissioned.

To return to the affairs of Great Yarmouth air station, as was the case on every air station, numbers of machines were constantly 'out of service'—many of them for comparatively trivial causes. This constant difficulty is accentuated in time of war owing to the almost certain delays in obtaining spare parts and material. As an example of this we have, in the middle of May, the 'Workshop Report' stating that:

'No. 20 (Short seaplane) awaiting nose-piece for engine since February 26.  
No. 156 (Henri Farman) being tuned up.'

No. 1052 (Sopwith aeroplane) obturator ring gone.

No. 1056 (Sopwith aeroplane) faulty oil system, also requires re-doping.

No. 1208 (Sopwith aeroplane) vibrating badly, requires cause looking into.

No. 1558 (Sopwith seaplane) requires new tail-piece.'

This report meant that, at the time, exactly half of the available machines on the station were 'out of service', and this naturally had a marked effect on the scope of the operations that could be conducted by the pilots of the station.

June was to witness many 'Zeppelin scares', as they came to be known. On the 6th Flight Lieutenant Nicholl, with Leading Mechanic Phillip as a passenger, flew off in a B.E. 2c at 8.20 p.m. and went to the northward, information having been received at the station that a Zeppelin airship had been sighted off the Haisborough light vessel. Observing nothing, he landed at Bacton to make inquiries, and was told that an enemy airship had been reported proceeding in a south-westerly direction from Cromer. Nicholl again ascended and, searching in vain for the airship, returned to Great Yarmouth, after having been in the air for nearly two hours.

An enemy raid had been planned for that night as a combined operation with naval and military airships. The naval airship was *L. 9* (Kapitänleutnant Mathy) and the military airships were *L.Z. 37* (Oberleutnant von der Haegen), *L.Z. 38* (Hauptmann Linnarz), and *L.Z. 39* (Hauptmann Masius). *L. 9* started from Hage in Germany, and the other ships from the sheds in Belgium. Almost as soon as she had left the ground *L.Z. 38* was forced to land on account of engine trouble, and the other two army airships—*L.Z. 37* and *L.Z. 39*—never reached the English coast, presumably on account of fog, and so turned back.

At 1.0 a.m. the next morning (June 7) *L.Z. 37* was sighted over Ostende by Flight Sub-Lieutenant R. A. J. Warneford, who was flying a Morane 'Parasol' monoplane, and was on his way to bomb the airship sheds at Berchem Ste. Agathe. He soon caught up with *L.Z. 37* and climbed above her and released his bombs, securing a hit, with the result that she burst into flames and fell to the ground near Gand. Owing to the violent air disturbances following on the explosion of the bombs and the burning of the airship, Warneford lost control of his machine, and this, coupled with the effect of a broken petrol pipe, compelled him to land in enemy territory. He managed, however, to repair the pipe and elude capture and return to his aerodrome. A few days later His Majesty the King conferred the Victoria Cross upon him for the

bravery he had shown during this action. Ten days after Warneford had destroyed this airship he crashed at Buc, near Paris, and was killed. . .

The same morning that *L.Z. 37* was destroyed (June 7) *L.Z. 38* was destroyed in her shed at Evere, near Bruxelles, by two pilots of the Royal Naval Air Service—Flight Lieutenant J. P. Wilson and Flight Sub-Lieutenant J. S. Mills—both of the Royal Naval air station at Dunkerque.

Although the army airships had failed in the raid planned for June 6 and had suffered heavy losses on their return, the naval airship *L. 9* fared better and inflicted severe casualties on us. She was commanded by the redoubtable Kapitänleutnant Mathy, who made his 'landfall' off Cromer (it was this airship for which Flight Lieutenant Nicholl had searched in vain); from there he passed over Theddlethorpe (in Lincolnshire) and proceeded along the coast to Flamborough Head. There Mathy turned about and arrived over Hull at about midnight, and, despite the fact that he was fired upon by H.M.S. *Adventure*, which was lying in dry-dock, he remained over the town for 20 minutes, dropped 52 bombs, which caused the death of 24 people and the wounding of 50, in addition to inflicting considerable damage to property. The airship then passed over Grimsby, where some incendiary bombs were released, but these inflicted little damage, after which action the airship went out to sea.<sup>1</sup>

These attacks caused some material damage and, what was more serious, produced considerable moral effect in England. For some time after the raid on Hull thousands of people went out into the country and slept in fields rather than remain in the town.

According to German accounts Hull and Grimsby were 'a blaze of lights' at this period, and in their opinion the civic authorities were mainly responsible for the damage inflicted being so great.

Another effect of these raids was to bring about a recrudescence of 'spy mania' in the country, and the innocent acts of patriotic people were frequently misrepresented as being highly treasonable. The authorities, at this time, started to enforce the 'darkening regulations' for street and private lighting, and as the War went on these regulations were more rigidly enforced until the lighting of the streets of large towns was not superior to what it had been 200 years before.

The authorities were inundated also with letters from civilians,

<sup>1</sup> Vide also *The German Air Raids on Great Britain, 1914-1918*, pp. 34-7.

either abusing them for not resorting to punitive measures against the enemy for making these raids (although we had no aircraft or organization available for such measures), or offering suggestions as to how the enemy raids should be combated. The majority of the proposals for meeting the menace consisted, in general, of laying out a series of lights in fields outside a town with the object of misleading the enemy, or by flood-lighting the sky with flares placed on the tops of balloons, with the object of imitating moonlight, for the enemy rarely attacked on moonlight nights. One woman suggested that, as 'ice was water and ice floated on water, the clouds, if made into ice, would of course still float in the sky'. Arising out of this, she suggested that certain clouds should be frozen and anti-aircraft guns, ammunition, stores, and crew lifted on to them, after which, the latter could roam about looking for enemy airships. She did, however, leave the technical problems associated with this proposal 'to the scientific members of the Government'.

At this point it seems desirable to devote some space to an account of the German policy dictating these raids, for, in the end, this reacted upon the Naval Air Service, and in particular upon the activities of Great Yarmouth air station.

Following on the raid of June 6 it is believed that the Staff of the Imperial German Navy pressed for a series of vigorous raids on London. It is understood that the Chief of the Naval Staff (Admiral Bachmann) stated that in his opinion to withhold such attacks would be construed by the German people as an act of foolishness, and by us as a sign of weakness. On June 16 the Chief of the General Staff (General von Falkenhayn) was approached on the subject, and it is believed that he was in favour of unrestricted raids, but he saw the difficulties of such a policy, for, in a memorandum of June 22, he stated, *inter alia*:

'Operations should not be opened in the present unfavourable period of short nights and inadequate material. Attacks have to be effectively carried out, otherwise they do more harm than good. Moreover, public approval does not help things forward, for the point is—not to raise the spirits of the German people, but to inflict serious damage on the enemy.'

Furthermore, it is understood that he expressed the opinion that the best results could only be obtained provided that there was strict co-operation between the naval and military airship branches, and he suggested that such combined operations should be under the control of the Chief of the Military Air Forces.

Admiral Bachmann objected to this proposal: firstly, because the previous attempt at co-operation on June 6 had been a failure, for *L.Z. 37* and *L.Z. 38* had been destroyed; secondly, that as the airships of the two Services operated from different sheds, weather conditions might prevent one or other of them from participating in an attack; thirdly, he did not consider that the Army had a sufficient number of airships to render their co-operation of real value; and, lastly, he believed that the naval airships were capable of achieving the desired result alone.

Under pressure, General von Falkenhayn bowed to this opinion, and Admiral Bachmann approached the Imperial Chancellor (von Bethmann-Hollweg), who, on July 9, sanctioned the making of raids on London, but they were, on humanitarian grounds, to be limited to week-ends, as then the City should be practically empty. Two days later the Emperor withdrew his sanction to this policy, but under pressure he, on July 20, gave his approval. Following this now settled policy, Korvettenkapitän Strasser and his staff began preparations for raiding on a much larger scale than before.

To meet the action of the enemy consequent upon this policy, consultations took place at home between the Admiralty and the War Office on the question of Home Defence and, in particular, on the desirability of retransferring this responsibility from the Admiralty to the War Office. The Admiralty defined the role of the Royal Naval Air Service as being fourfold. Firstly, the location of, and, where possible, the destruction of, hostile submarines; secondly, overseas reconnaissance for the location of hostile ships; thirdly, the spotting and observation work in connexion with the shelling by His Majesty's ships against hostile shore defences and forces; and, fourthly, attack on hostile aircraft when over the sea. The representatives of the War Office were asked when it was expected that the Royal Flying Corps would be in a position to assume once more the responsibility for Home Defence—one that had been delegated to the Admiralty on September 3, 1914. The answer was that the War Office hoped to be able to undertake the responsibility of Home Defence with respect to resisting attack from the air in January of the following year (1916).<sup>1</sup> Pending this retransfer of duties Admiral Sir Percy Scott, K.C.B., was appointed on September 12 to command the anti-aircraft defences of London.

To return to the operations at Great Yarmouth air station, on June 12 the personnel experienced their first real 'submarine

<sup>1</sup> Vide *The German Air Raids on Great Britain, 1914-1918*, pp. 61-3.

'scare', for a hostile submarine was reported off the coast. Squadron Commander Ireland with Leading Mechanic Hooks went off in an Henri Farman seaplane, followed by Flight Lieutenant Nicholl and Petty Officer Notley in a similar machine, and Flight Lieutenant Chichester Smith and Petty Officer Jones in the venerable *No. 20* (Short seaplane). Although all these officers searched the sea around Aldeburgh and the Shipwash light vessel, they failed to sight the submarine. Seven days later the presence of another hostile submarine was reported, but our aerial patrols failed to detect the enemy.

The activities of the air station during these summer months have been described subsequently by an officer, who was there at the time, as follows:

'The general routine of patrols was a submarine patrol on the Short some time during the forenoon on those very rare occasions when the seaplane would get off. It was a two-seater machine that would only carry the pilot, and was noted for its capacity to sling oil. The pilot flew with two 16-lb. Hale bombs on his lap, bomb frames being far too scarce in those days to fit to an ordinary seaplane, besides the extra weight stopped her "getting off". On one occasion it was known to have reached the prodigious altitude of 1,000 feet; the pilot, a very harmless, innocent "quirk", hardly fledged, straight from Chingford, having struggled with the machine for 2 hours, came home so full of life that he told every one, even the Commanding Officer, of his experience. "What the hell do you mean by doing a submarine patrol at that height for? You would never see a submarine from 1,000 feet, even if it was there!" and that was all the thanks he got from his C.O.

'Two hours before dusk an aeroplane patrolled from Yarmouth to Wells and back in order to scare off any hostile airships that might be meditating whether to attack England or not. The word "scare" is used with a purpose, for it was very much in the same sort of proposition as a small boy with a pop-gun scaring the birds off his father's gooseberries! It was always being discussed in the Mess as to what was the best point of a Zeppelin to hit when ramming it, this being considered the only real offensive.

'The machines were armed with a Service rifle fitted with Hale grenades, and a shot-gun firing chain shot, and a Véry light with two rounds of ammunition; this latter was considered the best weapon of offence. So loaded, with an observer sitting in a seat where he could see nothing and use none of his equipment, these Sopwiths might, if properly handled, attain 3,000 feet. Owing to the shape of the engine cowl the Gnome engine got very hot, so forced landings occurred on 50 per cent. of the trips.

'A certain R.N.V.R. officer, whose multifarious duties were summed up under the title of "Beach Officer", but whose principal occupation in life was that of beating erring Boy Scouts, numbers of whom were employed at the station in various capacities, went occasionally, when he could induce

a pilot to take him, as the observer on these patrols, and became very gallant with his motley equipment. Hand grenades and chain shot would be discharged *ad lib.* with utter disregard for the lives and property of his brethren on land and at sea. As he sat very close to the engine the propeller missed the muzzle of his gun by fractions of an inch, much to the detriment of both when they came into contact with each other, and greatly to the annoyance of the pilot. His dog, "Henry", was his master's constant companion on these trips, and would crawl down the fuselage into the controls. As has been said, it took a considerable amount of inducement to persuade a pilot to take him up.

'About the end of July 1915, tremendous excitement was caused by the arrival of 977, the first 70 Renault B.E. to be allocated here for night flying, two more of the same type following shortly afterwards. August and September 1915 were full of Zeppelin raids and warnings, and many night flights were done over the coast between Aldeburgh and Wells. Yarmouth and Bacton were the only landing-grounds. Thus a pilot with engine failure at Aldeburgh had some job to make Yarmouth. There were no searchlights or guns.'

On the occasion of the first anniversary of the outbreak of war (August 4) there were 27 machines on the station, of which 22 were 'ready for service'—a marked increase over the number in the previous year. This total was made up of Sopwith two-seaters (familiarly known as 'Spinning Jennies', because of certain peculiarities aptly described by their name), Bristol 'Bullet', Avro, B.E., and B.E. 2c aeroplanes, and Short, Sopwith, and Henri Farman seaplanes.

On the night of August 9 hostile airships were reported to have crossed the coast. At 10.30 p.m. Squadron Commander Ireland went off in the only B.E. on the station and, despite the fact that he patrolled as far as Southwold at a height of 5,000 feet, he failed to sight the enemy. On returning to the air station Ireland found the aerodrome enveloped in thick fog, and being unable to see he crashed on landing. He was not hurt, although 'his under-carriage was wiped off and he landed on his bombs'. This landing was described by an eyewitness, who said, 'there was a terrific whistling and a crash, and out of the wreckage stepped Ireland, swearing because another machine had not been warmed up, ready for him to take up'. The same evening Flight Lieutenant E. J. Cooper and Flight Sub-Lieutenant Egbert Cadbury<sup>1</sup> also

<sup>1</sup> This officer had joined the air station a few days beforehand. A Cambridge undergraduate, he joined the R.N.V.R. as an ordinary seaman at the outbreak of hostilities and served for some months in a mine-sweeper before being appointed to a commission in the R.N.A.S.

tried to find the hostile airships, but were defeated by the fog in their efforts.

On this night a raid was made over Goole, Lowestoft, Dover, and Eastchurch, for, following the policy of bombing London decided upon on July 20, Korvettenkapitän Strasser had been engaged in preparing for a series of raids, using many airships, he himself leading the formations. On this particular night Strasser, it is understood, had arranged that 5 naval Zeppelin airships should raid London (*L. 10, L. 11, L. 12, L. 13, and L. 14*), while one Zeppelin (*L. 9*) and two Schütte-Lanz airships (*S.L. 3* and *S.L. 4*) should raid the Humber and the Tyne. The latter-named airships were to be supported in the work of reconnaissance by two older Zeppelin airships, *L. 6* and *L. 7*, and by the non-rigid Parseval airship, *P.L. 25*.

Owing to bad weather, the attacks made by these airships were unsuccessful, for rain that fell during the night rendered them too heavy. Only one of them—*L. 10* (Oberleutnant Wenke)—succeeded in coming within 30 miles of London. *L. 11* (Oberleutnant Freiherr von Buttlar) dropped 12 bombs on Lowestoft, killing one woman, injuring 7 people, and wrecking some private houses. It is believed that it was *L. 10* and *L. 11* that Squadron Commander Ireland and his brother officers failed to sight. The raiders lost one of their number—*L. 12* (Oberleutnant Petersen)—for she was disabled by anti-aircraft fire near Dover, and, owing to the resultant loss of buoyancy, was compelled to alight on the sea near Zeebrugge. The airship was then taken in tow to Ostende by a German torpedo boat, and tied up to the quay at that place. While under tow she was attacked with bombs by Flight Commander J. R. W. Smyth-Piggott, who was flying a B.E. 2c from Dunkerque air station.

The total casualties inflicted on us that night (August 9/10) by the dropping of 83 bombs were 17 killed and 21 injured. The damage to property was not great.<sup>1</sup>

Four nights later (August 13/14) another raid took place, and at 7.30 p.m. Flight Lieutenant Chichester Smith left the air station in a Sopwith aeroplane to look for a hostile airship reported to the eastward, but heavy rain and mist forced this officer to return without having observed the enemy. Upon the same night Flight Sub-Lieutenant G. W. Hilliard, Flight Lieutenant Nicholl, and Squadron Commander Ireland also went off at intervals in B.E. 2c's, but all failed to see anything of the

<sup>1</sup> Vide also *The German Air Raids on Great Britain, 1914-1918*, pp. 43-8.

enemy, and the last-named officer crashed his machine on landing (owing to the bad condition of the ground) but escaped injury.

The airship these officers failed to find was *L. 10* (Oberleutnant Wenke), which appeared over Lowestoft at 9.20 p.m. and subsequently dropped bombs on Woodbridge, and later in the neighbourhood of Ipswich and Harwich, and finally went out to sea undamaged. Wenke dropped 47 bombs, which killed 6 people and, in addition, injured 34.

Another airship, *L. 11* (Oberleutnant Freiherr von Buttler), appeared off the coast at Orfordness, but experienced engine trouble (this officer always seems to have been unfortunate with the engines of the airships which he commanded) and retired without dropping any bombs on land.

Four nights later (August 17/18) the enemy made another airship raid, and Squadron Commander Ireland and Flight Sub-Lieutenants Cadbury and Hilliard spent most of the night in the air looking for the enemy, but ill luck dogged their efforts, for they failed to locate any of the airships.

Three airships took part in this raid—*L. 10* (Oberleutnant Wenke), *L. 11* (Oberleutnant Freiherr von Buttler), and *L. 14* (Kapitänleutnant Böcker)—the latter airship flying at sea off Great Yarmouth for nearly 3 hours. Of these airships *L. 10* was the only one to achieve any success, for Wenke managed to drop bombs on Leyton (damaging the railway station), Leytonstone, Wanstead Flats, and Chelmsford, while the Commander of *L. 14* reported that he had bombed 'the blast furnaces and factory premises in the vicinity of Ipswich and Woodbridge'; but in making this statement he was mistaken, as the bombs were dropped in the sea near the Cross Sands light vessel. Böcker also attacked a small steamer with machine-gun fire near the light vessel. The airship *L. 11* crossed the coast at Herne Bay and proceeded over Canterbury, Ashford, Faversham, and Whitstable, but although 62 bombs were dropped they did but little damage, mostly falling in open fields.<sup>1</sup>

The month of September saw a continuance of these raids, for on the night of the 7th two Zeppelin airships, *L.Z. 77* (Hauptmann Horn) and *L.Z. 74* (Hauptmann George), and one Schütte-Lanz airship, *S.L. 2* (Hauptmann von Wobeser)—all army airships—raided East Suffolk and London, inflicting many casualties—18 killed and 38 injured—but the material damage did not exceed £10,000.

<sup>1</sup> Vide *The German Air Raids on Great Britain, 1914-1918*, pp. 51-3.

A hostile airship, now known to be *L.Z. 77*, was reported off Great Yarmouth in the early hours of the morning of the 8th, and at 2.15 a.m. Flight Sub-Lieutenant C. E. Wood patrolled to the area between Caister and Kessingland for 2 hours in a B.E. 2c, but failed to sight the airship.

The following night (the 8th) four naval airships set out to raid this country. It is understood that *L. 11*, *L. 13*, and *L. 14* intended to attack London, and *L. 9* industrial districts in the north. Oberleutnant Freiherr von Buttlar of *L. 11* again experienced engine trouble and turned back almost as soon as he left the ground, but the other airships carried on.

At dusk information was received at the air station of the imminence of this raid, and Flight Lieutenant Nicholl (who was 'duty pilot' in the trawler *Kingfisher*) rose in a Sopwith seaplane. The *Kingfisher* then lay out at sea 40 miles from Great Yarmouth, but she had been told by wireless telegraphy of the impending raid. Nicholl remained in the air for some time, but, owing to mist, failed to sight any of the airships, and returned to the *Kingfisher*—which he found despite the fog—alighted safely, and was hoisted inboard. At 7.45 p.m. Squadron Commander Ireland flew off in a B.E. from the air station, but a few minutes later all the cylinder heads of his Renault engine blew off, and he was thus compelled to make a forced landing, which he did in the dark, without damaging either the machine or himself. Five minutes after this officer had left, Flight Lieutenant J. M. R. Cripps flew off in a B.E. 2c and endeavoured to locate the approaching airships, and at 9.0 p.m., when he had been flying for one hour and ten minutes, his engine stopped, due to the pilot having forgotten to pump petrol from the main supply tank to the gravity tank. This oversight compelled a forced landing. The manner of this landing was described in the 'Daily Report' as follows:

'Owing to complete darkness and mist on the ground, the pilot could see nothing but blackness underneath him, and as he was afraid of his bombs going off if he hit a house or a wall, he landed in the following manner. When his altimeter showed 100 feet he stepped out on to the planes, still holding his control lever. He held the machine down for about 6 seconds and then jumped off the machine, and he fell on his shoulder on some soft mud and was unhurt. The machine landed by itself and sustained very little damage.'

One of his brother officers remarked at the time that 'he was absolutely scared stiff—not by his landing, for he wasn't scratched—but by the cows that came up and smelt him and his machine'.

He and his machine landed in the Caister Marshes, north of the town, and next day the machine was dismantled by a working party under Warrant Officer H. C. Bobbett and brought to the air station. This incident was but one of many which demonstrated the inherent stability of this particular type of machine.

Unfortunately, that night another pilot had not such good luck, and the station suffered its first war casualty. A few minutes after 8 p.m. Flight Sub-Lieutenant G. W. Hilliard flew away in a B.E. 2c to look for the enemy, with orders to patrol for 2 hours between Lowestoft and Cromer, and at the end of the patrol to land either at Great Yarmouth or Bacton, preferably the latter. Within two minutes of the two hours he started to land at Bacton (where landing flares had been lit), but misjudged his distance and landed short in a field adjoining the aerodrome. The under-carriage of his machine collapsed, the bombs exploded in their frames, and he was killed instantly. As a result of this accident pilots at the air station were ordered not to carry bombs when flying at night, and in the day-time to drop them over the sea before landing. Later, when the detonating gear of the bombs proved more reliable, this order was rescinded.

To return to the description of the raid, by 9.0 p.m. the three hostile airships had crossed the coast. The airship *L. 14* (Kapitänleutnant Böcker)—which was one of the airships that pilots from the air station tried to find—crossed north of Great Yarmouth and dropped some bombs on Bylaugh Park and East Dereham (about 15 miles east of Norwich) and afterwards proceeded out to sea, while *L. 9* (Kapitänleutnant Loewe) crossed, at approximately 9.0 p.m., the coast between Whitby and Kettleness. She dropped most of her bombs in the neighbourhood of Skinningrove, where there was a large explosive factory. The factory had a fortunate escape from destruction, for one of these bombs hit the cover of a container full of tri-nitro-toluene, but did not explode. The third airship, *L. 13* (Kapitänleutnant Mathy), proceeded over London by way of King's Lynn and Cambridge. This airship was another one which pilots from Great Yarmouth air station had also failed to find. When over the City Mathy dropped 15 high-explosive and 55 incendiary bombs, causing great loss of life and many casualties, as well as inflicting material damage estimated at £500,000—in fact, more damage was done to the City as a result of this airship raid than by any other.<sup>1</sup>

Although much space has been devoted in this narrative to the

<sup>1</sup> Vide *The German Air Raids on Great Britain, 1914-1918*, pp. 55-8.

recording of the activities of the air station with respect to the offensive measures taken against hostile airships, it must not be thought, by reason of this, that the other duties of the station were neglected, for sea patrols were regularly conducted so far as practicable with the machines which were available.

At the beginning of October Squadron Commander Ireland left the station for special duty at the Admiralty and, on the 6th, Flight Commander C. Hornby was posted from Dover seaplane station to take temporary command at Great Yarmouth. During this month the weather was very bad and little flying was done except occasionally when patrols in Sopwith seaplanes from the trawler *Kingfisher* were made.

In the first week of November a number of officers joined the station—Flight Sub-Lieutenants F. N. Halstead, G. W. R. Fane, A. E. Hawker, R. Spickernell, and J. B. Cussen. One of them has since given a description of the activities of the station at this period, saying :

'In November the total complement of officers and men was about 100, and not more than 15 machines of various types, seaplanes and aeroplanes—safe and unsafe. For the most part they were good of their type and considering all things at that time they were reliable. Of the seaplanes, the Canton Unné Short was a wonderful machine. It always started when required, and always got off the water quicker than any other type of Short, and that usually with a greater load than it was ever intended to carry. So far as I can remember, it never let any one down, which is rather a marvellous record, as I don't think there was any one at the time who understood anything about the engine at all, and beyond cleaning the plugs it was left severely alone.'

'Of the land machines, the best were the 70 Renault B.E. 2c, and the 80 Gnome Bristol Scout. Until the arrival of the D.H. 4 the B.E. 2c was the best night-flying aeroplane we had, and this type was most successful in attacking hostile aircraft at night until the latter part of 1917, when the performance of the Zeppelins got too good for it. . . . One's turn of duty came every other week when one took a machine to any of the night landing-grounds and remained there a week. After one particular raid, when Yarmouth Town had been bombed but not badly damaged, it was decided that some flares should be lit in a field near Burgh Castle, behind the town, in order to mislead the Zeppelins as to the exact position of the air station. This plan worked admirably the first time of asking, and it was most unfortunate that the station did not have the distinction of destroying the first Zeppelin in England.<sup>1</sup> It happened that there were at the time numerous

<sup>1</sup> S.L. 11 shot down in flames over Cuffley, on September 3, 1916, by Lieutenant W. Leefe Robinson, No. 39 Squadron, R.F.C.

devices fitted to the machines for destroying Zeppelins: on my own machine I had 28 rifle grenades hung in a compartment underneath, which one, by means of wires, released 7 at a time.'

The night-flying grounds that are referred to in this account came into being in September, October, and November of this year. The first was at Rockford, which was commissioned on September 20 by Squadron Commander Frank K. McClean and Flight Lieutenant H. O'Hagan. It was decided later to form other such stations at Sedgeford near Hunstanton, at Narborough near Swaffham, and at Burgh Castle near Lowestoft. The two at Covehithe and Aldeburgh were commissioned in September and October and were commanded by officers of the Royal Naval Volunteer Reserve, and by November, 7 officers had been appointed for these duties, by name, Lieutenants W. S. Lockyer, J. H. Spottiswood, F. W. Hodges, and J. H. Lee, and Sub-Lieutenants A. Scarrisbrick, F. Smythe, and H. C. Mallett.

It may be remembered that on October 26, 1914, the Admiralty Air Department had given instructions that all the machines in the Royal Naval Air Service were to have a Union Jack painted on the underside of the lower planes, to distinguish them from enemy machines. This method had not been found satisfactory (moreover, the device was an expensive one to produce), and so, at the end of November (1915), it was decided to replace the Jack by another device consisting of concentric disks of red, white, and blue, such disks to be painted on the ends of the top surfaces of the upper planes and the undersides of the lower planes, and also on both sides of the fuselage, in the middle. The inner disk was red, and later a narrow white circle was painted around the outer edge of the blue disk. The rudders were painted with red, blue, and white vertical stripes of equal width. This method of marking was adopted from the practice which obtained in the French Air Services, only that their machines had the blue disk in the middle with the red ring outside. Towards the end of the War, machines of the Royal Air Force, engaged in night operations, merely had red and blue concentric disks painted on them, as it was found that searchlights shining on the white disks rendered them much easier to detect from the ground.

At the beginning of December Squadron Commander Ireland again resumed command of the station, and despite the bad weather experienced during that month a considerable amount of flying was done by the 13 officers at the station—Squadron Commander W. P. de Courcy Ireland, Flight Lieutenants J. M. R.

Cripps, E. J. Cooper, V. Nicholl, Chichester H. Smith, and Flight Sub-Lieutenants E. Cadbury, G. W. R. Fane, F. N. Halstead, F. G. D. Hards, B. R. Lee, F. E. Sandford, W. T. S. Williams, and C. E. Wood. The majority of these officers were entitled to the cryptic letters after their names in the Navy List—'P.A.', 'P.S.', 'N.F.', which meant that they were qualified 'pilots aeroplane', 'pilots seaplane', with experience in 'night flying'.

Very often as many as 18 flights were made during a day, and, generally speaking, there were not more than 20 machines 'effective' at one time. At the end of this month there were 31 machines on the station—7 Avros, 6 B.E. 2c's, 4 Bristol Scouts, 2 Short seaplanes, and 12 Sopwith aeroplanes and seaplanes.

During the year under review the activities of the air station had been concentrated very largely on anti-airship work, and it may be wondered why the pilots failed to achieve any success. The cause of this failure may be attributed to the technical superiority of the Zeppelin airships over our aeroplanes, the lack of suitable armament in the attacking machines, and, most important of all, defective ground organization on our part.

The B.E. 2c machine (which was used so largely for night-flying operations), when fitted with the 90 b.h.p. Raf engine, had a speed of about 72 miles per hour and its ceiling was approximately 10,000 feet, but with a full war load it took 45 minutes to reach this height. The *L. 10* class of Zeppelin had a speed of 98 kilometres (61 miles) per hour and a *static* ceiling of 3,900 metres (12,800 feet), but like all airships they could be forced up or down while in flight by the aerodynamic reaction of the hull and fin areas, due to inclining the airship to the line of flight. A very powerful lifting effort may be obtained by this method, and the ship caused to ascend until the static excess of weight equals the dynamic lift. When proceeding at full speed at an inclination of 10 degrees, the dynamic lift may be as much as one-tenth of the total static lift of the airship. So, when an airship was attacked, either by aircraft or when shells from anti-aircraft guns burst too close to her for safety, she was able to rise at a much more rapid rate than could the attacking aeroplanes.

Squadron Commander Ireland, in common with many others, was not content with our failure to destroy a Zeppelin airship, and he associated himself with Wing Commander N. F. Usborne (the commanding officer of Kingsnorth airship station) in some experiments which had as their aim the combination of certain of the qualities possessed by the aeroplane and the airship. To

this end these two officers evolved what was called an 'airship-plane', for they slung a complete B.E. 2c aeroplane under the envelope of an S.S. type of airship in such a manner that the machine could be released in the air and flown away at the will of the pilot. Until the aeroplane was released, the combination was to be handled and steered as an airship. By the aid of this device it was hoped to give to the machine the attributes of high ceiling and an endurance which by itself it did not possess.

Originally it was arranged that the pilot should open the gas-valve of the envelope before slipping his machine, so that it—the envelope—might drop slowly to earth.

The first trials to test the flying capabilities of this composite craft were made by Flight Commander W. C. Hicks in August 1915 and, as they revealed certain weaknesses in the controlling gear, no attempt was made to slip the machine. The defects were remedied, but on the day of the next trial (February 21, 1916), as shall be recounted later, both of the originators of this device were killed.

To return to the causes of our lack of success against hostile airships, the machines we used were ill equipped with armament and suitable incendiary ammunition. A service rifle, firing ball ammunition, could not bring an airship down in flames. Pilots were also supplied with shot guns firing chain ammunition, but they never had a chance (in 1915) of coming within effective range so that they could use this weapon. They were supplied with another device—Ranken darts. This dart was the invention of Engineer Commander F. Ranken, R.N. It consisted of a hollow tin cylinder, about the size of a large candle; the bottom was closed by a pointed bullet of steel or iron and its top by a lid of tin through which passed a spindle capable of vertical movement and terminating at the end outside the dart in four flanges or vanes. The cylinder was filled with incendiary composition which was fired after the fashion of a Christmas cracker. For this purpose a strip of friction match had one end attached to the cylindrical body and the other to the spindle. Then, if the dart fell upon a Zeppelin airship from above, its sharp bullet point would enable it to penetrate the outer covering upon which, however, the four flanges or vanes would catch, a jerk would thus be given to the spindle, causing the match to be torn apart and ignited, and the dart, held fast in the cover of the airship, would burst into flames. They were stored inside a container (which held 24 of them) and were released from it 3 at a time.

In order to use these darts the pilot had to be above the airship—and, as pilots pungently remarked, 'it was the old story of catching the "dicky-bird" by putting salt on its tail—the job is to get near the bird'.

The effect of the lack of ground organization on anti-airship operations has since been summed up by a very experienced pilot of the air station who, commenting on the difficulties that pilots experienced in seeing airships from their machines, remarked that:

'The Zeppelins naturally chose very dark nights for their raids. If one was on the ground, one could naturally locate the direction from which the Zeppelin was coming by the noise of its engines and propellers, and probably pick out fairly easily its outline against the stars or clouds. What wants to be made absolutely clear is that although there were 130 miles of coast-line from Felixstowe to King's Lynn, which were patrolled by aeroplanes from Great Yarmouth, there were, perhaps at the very most, only two or three searchlights, two of which were aboard the monitors which were stationed in Lowestoft and Yarmouth harbours.

'A pilot, therefore, had an extremely small chance when up in the air of spotting a Zeppelin in the pitch darkness because, owing to the noise of his own machine, he naturally could not hear those of the Zeppelin. Furthermore, owing to the complete absence of any anti-aircraft guns along the whole line of the coast, Zeppelins could come in at practically any point they liked, at any height. It therefore happened (at least in one case) that a Zeppelin came in below an aeroplane. The one instance I refer to occurred to a pilot when over Bacton (July 31, 1916). He was up, I suppose, 8,000–9,000 feet on a Zeppelin patrol, and the people at Bacton actually saw a Zeppelin come in fairly low down, directly under him. Had the Zeppelin been picked up by a searchlight, it would, of course, have been easy meat. As it was, the pilot was unaware of its close proximity until he landed about an hour later, by which time, of course, it was miles away.'

'Even when Zeppelins were caught in the searchlight, by a little manœuvring, and dropping the ballast or bombs, they easily shot up into a cloud and evaded further illumination. London was, of course, ringed by searchlights and night landing-grounds, and therefore, finding or locating Zeppelins should have been a matter of ease, compared with the difficulties experienced by pilots on the coast, as Aldeburgh to Covehithe is 15 miles, Covehithe to Yarmouth 16 miles, Yarmouth to Bacton 20 miles, Bacton to Holt 18 miles, Holt to Hunstanton 25 miles, Hunstanton to Narborough 18 miles; therefore, even if patrols had been done in a straight line, Yarmouth had a big area to cover.'

'These distances only obtained if the patrols were flown in a straight line from the various points, but actually, of course, pilots went some way out to sea, as on quite a number of occasions Zeppelins were known to be over Haisborough lightship, and travelling down the coast out to sea, dropping their bombs in the sea before making off back to Germany.'

To sum up the work done during 1915 by Great Yarmouth air station and its sister stations, as well as that of the German seaplane stations, it may be said that it was a year of experiment and development, both sides being aware that the science of aeronautics and its technique were not advanced sufficiently to make practicable the provision necessary for sustained combat in the air.

## X

### THE GENERAL DEVELOPMENT OF THE ROYAL NAVAL AIR SERVICE DURING THE YEAR 1915

IT is now desirable to devote some attention to the internal affairs of the Royal Naval Air Service during 1915—matters that concerned details of discipline and supply of material—for such had, of necessity, an effect on all air stations.

In February the Admiralty decided that the whole of the Royal Naval Air Service should be placed forthwith under the orders of the Director of the Air Department, who was to be solely responsible to the Board of Admiralty. The Central Air Office was abolished and Captain F. R. Scarlett, R.N., was appointed to the staff of the Air Department for inspection duties. This decision, however, created difficulties connected with discipline, and such points were raised at once by the Commander-in-Chief at the Nore. This officer urged strongly 'the re-establishment of some Central Air Authority in the port under my command with whom I can deal on defence and other important matters without reference to the individual air stations, which may often be commanded by officers of small naval experience, to whom the naval aspect of the situation may not especially appeal'.<sup>1</sup>

The Royal Naval Air Service felt that, owing to the technical nature of the work, the question of punishments should not be relegated to any one outside the Service. The Commander-in-Chief at the Nore had invoked the King's Regulations, so the question was referred to the Naval Law Branch of the Admiralty, which, in April 1915, replied that 'the discipline of the Air Service is governed entirely by the King's Regulations, which provide that the powers conferred upon commanding officers by the Naval Discipline Act shall be subject to the approval of a Flag officer whose flag is flying, or the Senior Naval Officer. . . . As a matter of fact, the Director of the Air Department has no disciplinary powers under the Naval Discipline Act.'

This verdict threw, once more, 'the organization of the Royal Naval Air Service into the melting-pot'. The question of discipline was at the root of the whole difficulty. The Navy was not willing 'to hand over the control of discipline to a body which, though it was called the Royal Naval Air Service, was much

<sup>1</sup> Vide *The War in the Air*, pp. 482-7.

looser in discipline than the Royal Navy'—albeit full of enthusiasm.

On August 1 (1915) the regulations for the reorganization of the Royal Naval Air Service (foreshadowed in February and approved in July) took effect. The opening words of the new regulations ran thus:

'The Royal Naval Air Service is to be regarded in all respects as an integral part of the Royal Navy, and in future the various air stations will be under the general orders of the Commander-in-Chief or Senior Naval Officers in whose district they are situated.

'The Commander-in-Chief or Senior Naval Officer will visit the stations within his command or district from time to time, or depute a suitable officer to visit them on his behalf, to ensure that the discipline of the station is maintained. . . . Copies of reports on operations are to be forwarded direct to the Admiralty. It will be the duty of the Director of the Air Department to visit the various air stations from time to time . . . with a view to ensuring that the technical training of the personnel is being carried out as laid down by their Lordships, and that the station is sufficiently organized and equipped in respect to works and material.'<sup>1</sup>

By this time there were more than 50 naval air stations in commission, and by virtue of these regulations they were placed in various groups for disciplinary and operational purposes. Changes were made in appointments at the Admiralty Air Department. The post of Director of the Air Department was abolished and that of Director of Air Services substituted, and to this post Rear-Admiral C. L. Vaughan-Lee was appointed. Commodore Murray Sueter was placed in command of the Construction Branch, with the title of Superintendent of Aircraft Construction —his two assistants were Wing Commanders R. M. Groves and E. A. D. Masterman. Arising out of these changes, considerable alterations were made in the Admiralty arrangements for design, supply, and inspection of aircraft, and the Air Department was reorganized with Organization and Construction Branches. Other changes which followed were so numerous that, 'in effect, a new Service was formed.'

So ended another crisis in the Air Service, bringing to mind the words of General Nivelle, that 'as long as there was aviation, there would always be a *crise* in it'.<sup>2</sup>

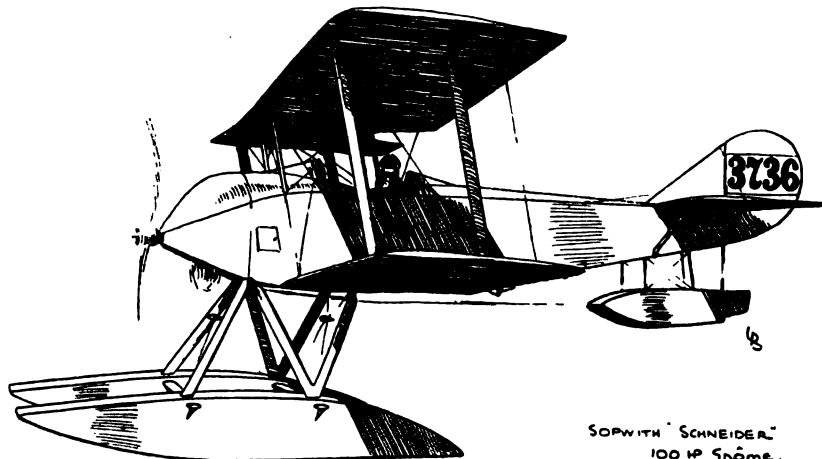
At Great Yarmouth air station, as at most large stations in the Royal Naval Air Service, the machines in service at the end of the

<sup>1</sup> Vide *War in the Air*, vol. i, p. 485, and vol. ii, pp. 353–6.

<sup>2</sup> *R.F.C. H.Q.*, p. 211.

year (1915) were Short, Wight, Sopwith, and Farman seaplanes, and B.E. 2c, B.E., Avro, Sopwith, and Bristol aeroplanes.

The various Short seaplanes bore the lion's share of the sea patrols of the War, and were produced in larger numbers and by more different contractors than any other British seaplane. In general aspect all these seaplanes were similar—they were twin-float machines built with folding wings of wide span and narrow gap, and were fitted with tail and wing-tip floats. They were equipped, during 1915, with various types of engines—the 80 and 100 b.h.p. Gnome, the 135 b.h.p. Canton-Unné, and



the 150 and 225 b.h.p. Sunbeam. It was during 1915 that the 184 type, with the 225 b.h.p. Sunbeam engine, was first flown. This machine was originally designed as a torpedo-carrier, but various modifications of it were constructed and different engines were installed in it: for example, the 240 b.h.p. Renault-Mercedes and the 260 b.h.p. Sunbeam.

The Wight seaplane, equipped with the 200 b.h.p. Canton-Unné engine, was of similar type to the Short, but its aerodynamical qualities were inferior to its prototype and it did not remain long in service.

In the early months of 1915 the Sopwith Aviation Company produced a small, single-seater, float seaplane from the original seaplane designed and built by them for the Schneider Trophy Race of the preceding year. This machine was fitted with various rotary engines—100 b.h.p. Gnome Monosoupape, 110 and 130 b.h.p. Clerget—and gave excellent service till the end of hostili-

ties. Another Sopwith seaplane was in use, a two-seater, tractor machine, fitted with folding wings, and equipped with the 100 b.h.p. Gnome engine.

The Farman seaplanes were similar to the land machines built by that firm, except that they were fitted with floats; a 100 b.h.p. Gnome was installed in them.

Of the aeroplanes, the most widely used was the B.E. 2c. In this machine the planes were staggered, i. e. the upper part projected over the lower, to give a better view of the ground. It had ailerons instead of warped wings, its tail was of different design to its predecessors,<sup>1</sup> and it was inherently stable. The speed of this machine was improved at successive stages by altering the wing section and by using engines of higher power, being fitted at different times with the 70 and 80 b.h.p. Renault and 90 b.h.p. Rafra engine. The B.E. 2c was used as a 'general purpose' machine throughout 1915 and 1916. There was much controversy as to its value, but there can be no doubt that it enabled the Royal Naval Air Service and the Royal Flying Corps to carry on for many critical months before other machines became available. In numbers it formed from 70 to 80 per cent. of the total number of aeroplanes in use up to the middle of 1916. Its extreme stability made it unsuitable for quick manœuvring, and with the advent of aerial fighting, in the middle of 1915, this drawback brought the machine into disfavour as a fighter.

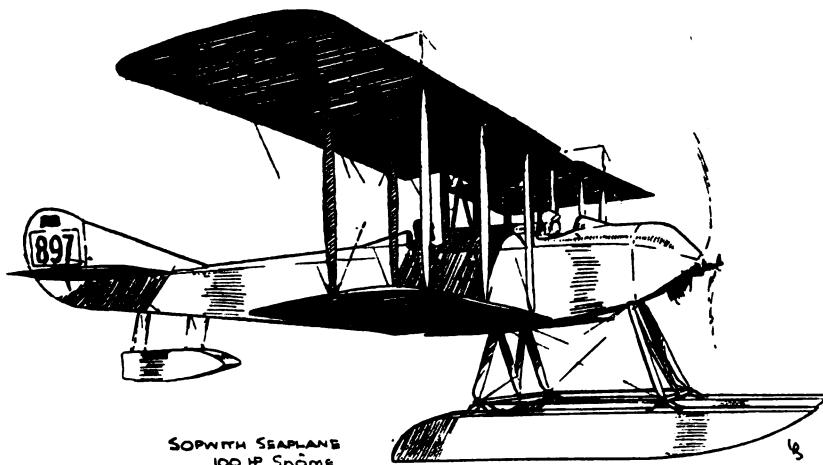
The Avro machine, fitted with the 80 b.h.p. Gnome engine, was in use as a war machine for about a year. It was a useful machine, but neither pilot nor observer had full freedom of action, and it was discarded when more convenient machines were provided. The Avro was used chiefly as a 'stop-gap' pending the production of the B.E. 2c, but it proved valuable as a training machine up to the time of the Armistice, and even to-day (1928) in an improved form it is the standard machine for the training of pilots.

The Sopwith machines were a two-seater, tractor machine, known as the 'Spinning Jenny', and equipped with the 100 b.h.p. Gnome engine, and the 'Tabloid'. In its original form the 'Tabloid' was built as a 'side-by-side' two-seater, with an 80 b.h.p. Gnome engine. It was built for the late Mr. Harry Hawker (the famous Sopwith pilot) to be taken out to Australia in 1914, but soon after its appearance a number of single-seaters of similar type were ordered for the Services. The machine had a skid type of undercarriage and a balanced rudder, while there was

<sup>1</sup> The B.E. 2a and B.E. 2b.

no fixed vertical fin; lateral control was obtained by wing warping, though in the Service machines ailerons were fitted. In addition to its maximum speed of 92 miles an hour the 'Tabloid' was remarkable in those days for its great speed range, as it would fly at as low a speed as 36 miles an hour—a performance unrivalled at the time.

The Bristol 'Bullet' was a high-performance, single-seater, tractor machine, equipped with the 80 b.h.p. Gnome and Le Rhône engines, and, later, with the 130 b.h.p. Clerget engine. There were, of course, many other machines in the Royal Naval



Air Service, but as they were not issued to Great Yarmouth air station they will not be dealt with in this story. It may be said also that the year saw a rapid expansion of the naval airship service,<sup>1</sup> starting with the Submarine Scout non-rigid type. The name was abbreviated to *S.S.* airships, but they were generally known as 'Blimps'.

With regard to the technical development of the Service in general, owing to the fact that the Royal Naval Air Service was undertaking many duties which were not, strictly, of a naval character, the attention of the Admiralty Air Department became concentrated on the production of land aircraft, rather to the exclusion of seaplane development. The policy of the Department, at this time, was focused on the development of, firstly, the heavy, bomb-dropping type of aeroplane, capable of carrying

<sup>1</sup> Vide *The War in the Air*, vol. ii, pp. 462-3, and *British Airships, Past, Present, and Future*, pp. 95-111 and 145-55.

500 lb. of explosives for a 150-mile journey; secondly, a small, single-seater, fighting machine, with a high rate of climb, great speed, and a machine-gun capable of firing through the rotating airscrew; and, thirdly, torpedo seaplanes, with the object of employing them for night attack on German ships at anchor.<sup>1</sup>

The urgent necessity of the supply of home-built engines was appreciated to the full this year, and the Royal Naval Air Service concentrated chiefly on the development of the Rolls Royce and Sunbeam products, and the latter firm produced an 8-cylinder, Vee-type, water-cooled engine, developing 150 b.h.p. and, later in the year, one giving up to 225 b.h.p.

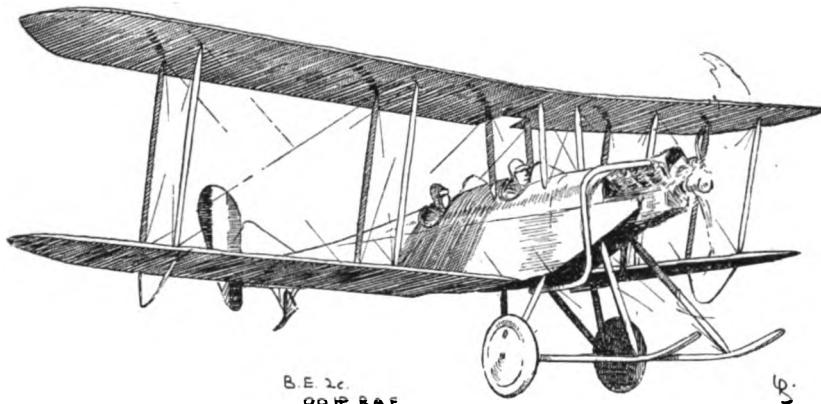
Turning now to the subject of aircraft armament, no great progress was made this year, although more machine-guns were issued to air stations and squadrons, but not in sufficient quantities to equip all machines. With the increasing use of tractor machines, attention was drawn to the necessity for some form of interrupting or synchronizing gear which would allow a machine-gun to be fitted in the nose of such a type of machine and would prevent its bullets hitting the blades of the airscrew. The French pilot, Garros, had fitted steel deflecting plates on to the blades of the airscrew of his machine, and such a method was copied by us, but it was not satisfactory. In May the German Air Services started to use on the Western Front the Fokker monoplane, which was equipped with a mechanical interrupter gear, and with the aid of this device they secured an immediate tactical success, and it was not until 1917 that we armed our machines with a gear superior to that of the enemy. Until the end of the year 1915 our aeroplanes and seaplanes which carried machine-guns supported them on crude mountings improvised by the personnel of the units. Most of these mountings were of the top plane type, in which the gun was fitted in an almost inaccessible position and arranged to fire over the top of the airscrew.

No standard machine-gun mountings were available until the autumn of 1915. The first one used in the Royal Naval Air Service was the Scarff 'Socket and Pillar Mounting', which consisted of a number of metal posts on either side of the structure, and a socket attached to the machine-gun, in order to enable its position to be changed readily from side to side of the machine as required. This mounting (which was the invention of Warrant Officer F. W. Scarff, who, it may be remembered, had been in the Naval Air Service since 1912), though extensively used in

<sup>1</sup> Vide the First Lord's minute of April 3, 1915, in *The World Crisis*, 1915, p. 541.

airships and some aeroplanes, was only designed to cope with the shortage of machine-guns at that period and to fill the gap until the 'Scarf Ring Mounting' could be produced.

During 1915 development was marked by the improvement of existing bombs and the evolution of new ones, the most satisfactory of which were those evolved by the Director of the Admiralty Air Department in conjunction with the Chief Superintendent of the Royal Ordnance Factory. These particular bombs were the 16, 65, 100, and 520-lb. 'light case' and the 550-lb. 'heavy case' types; in addition to these, some of those



produced by the Cotton Powder Company, Ltd., gave good service. Considerable progress was also made with the gear for carrying and releasing bombs.

With respect to the form of bomb sights, at the beginning of the year (1915) a simple lever with an angle scale was used, and the necessary table of angles was carried in the machine, but during the year the C.F.S. bomb-sight scale was invented. This was a noticeable step towards accuracy in bomb-sighting, and this instrument was adopted both by the Royal Naval Air Service and the Royal Flying Corps.<sup>1</sup>

Considerable development occurred during 1915 in wireless telegraphic apparatus; the earliest advance was the use of the Sterling spark coil transmitter and receiver. This set was made first by the Sterling Telephone Company from the designs and rough model prepared in October 1914 by Lieutenant B. Binyon, R.N.V.R., the wireless telegraphic officer of Eastchurch air station. By the end of the year a chain of Directional Finding

<sup>1</sup> Vide *The War in the Air*, vol. ii, pp. 119-20.

Stations had been established around the coast. For the patrol area off the east and north-east coast these special wireless stations were situated at Peterhead, Berwick, Flamborough Head, and Lowestoft; for the Dover Straits, at Sandwich, Lydd, and Pevensey; for the Irish Channel, at Kirkistown, Larne, Skerries (Drogheda), on the Irish coast, and at Rhyl and Amlwch (Anglesey); for the St. George's Channel, at Ross Carberry and Pembroke; and, lastly, for the south-western approaches to the English Channel, at the Lizard and Prawle Point.<sup>1</sup>

The year also saw the formation, in the Air Department, of a special photographic section, and the inauguration of units for such work on air stations and with squadrons. The photographic section of the Air Services expanded continually throughout the War, and proved of immense value in the work of reconnaissance.<sup>2</sup>

In any discussion concerning developments at this period, it is essential to bear in mind the problem of 'supply' as it affected the Royal Naval Air Service. The policy adopted by the Admiralty was to encourage private design work, and the Royal Naval Air Service was so placed that the policy could be pursued with the best results. The knowledge of manufacturing resources possessed by, and the prestige of, the naval Service amongst engineering firms were, by themselves, advantages, and firms which had Admiralty contracts were exceptionally well situated for obtaining material. In addition, most of the firms employed on such contracts for aeroplanes were, moreover, pioneers in aircraft work. The policy was, however, in the end to defeat itself as the Navy and Army became more and more competitors in the same market for the same articles, until, eventually, the utmost confusion arose.

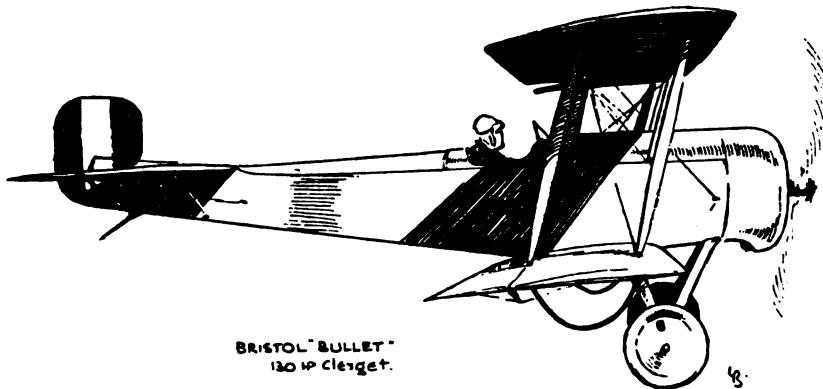
The adoption of any type, either of aircraft or engine, was in the nature of a gamble, as its merits could not be assessed without actual air experience, and, because this took months to gain, selection had to be made and production started on any machine which appeared to offer a promise of satisfactory performance. This led to a continuous stream of modifications affecting every part of the machine and entailing scrapping and, in consequence, delay. The effect upon manufacturers was disheartening, and the

<sup>1</sup> Vide *The War in the Air*, vol. ii, p. 391.

<sup>2</sup> For a survey of the development during the War of the application of photography for aerial purposes, vide a paper 'On some Photographic Apparatus used in Aerial Photography', by Major Charles W. Gamble, O.B.E., in the *Transactions of the Optical Society*, March 1919.

constant alteration in prices involved the making of contracts and entailed finance departments for control, while the drawing offices, inadequately staffed to meet even the normal demand for original drawings, were utterly unable to cope with the stream of alterations required. The complex nature of the industry, and the large number of sub-contractors involved in the production of aircraft, added to the difficulty, as their resources and works organization were often inadequate to make changes as quickly as was possible at the chief contractors' works.

The simplest way of dealing effectively with the problems in-



volved would have been to standardize types and components, but this, during the first three years of the War, was impracticable and, from many points of view, undesirable. From the manufacturing point of view some variation in type was advantageous, because it enabled the employment of a number of small firms whose factories were suitable for one class of work—and could not readily have been altered so as to become suitable to any other purpose—with the result that production was increased.

The Air Services were constantly required to undertake fresh duties for which special types of machines were needed, while the demand for improved performance on the part of the machines was constant. Machines became obsolete very quickly, owing sometimes to the rapidity with which better types were evolved at home, and sometimes they were *virtually* obsolete, owing to the fact that they were outclassed by enemy craft.

Yet, with all these difficulties (which were ever growing) the year 1915 did see a solid advance in the matter of supply. If the

output of aircraft from the outbreak of war to the end of December 1914 be compared with that of the year 1915, it will be found that, including machines for both Air Services and from all sources, home or foreign, the number of single-seaters rose from 30 to 391; two-seaters from 107 to 2,003; seaplanes and ship aeroplanes from 52 to 262. Taking all types of aircraft, the production of 1915 was 110 per cent. higher than the stated period of 1914.

In engines the output from all sources for the period stated in 1914 was 138—in 1915 it was 2,632. In the 1914 period we produced 99 engines—in 1915 this amount had increased to 1,721.

Supply was the vital problem of the day. It had been clearly shown by our reverses, both in France and at the Dardanelles, that there should be some authority charged with the duty of dealing with the problem as a whole. This authority was at length, in the May of this year, after a ministerial crisis, constituted; and the Ministry of Munitions came into being. This new department did not handle the production of aircraft until nearly two years later; but towards the end of this year (1915) a few people became insistent for some co-ordination between the two flying Services, in order that the technical equipment of one branch should not suffer as compared with the other. This feeling arose partly as a result of the enemy airship raids—for the country felt our impotence very strongly in the face of them. Although it was not, at this period, proposed to combine the two Services, because it was clear that for a long time to come the great bulk of the work in the air would be definitely of naval or military character, there was a strong body of opinion in favour of the appointment of an Air Minister who should have entire control of the supply of the Air Services and should be of status equal to that of the First Lord of the Admiralty and the Secretary of State for War.

## XI

### THE ACTIVITIES DURING 1915 OF THE GERMAN AIR STATIONS OPPOSED TO GREAT YARMOUTH AIR STATION

DURING the year 1915 the activity of the Imperial German Navy, in so far as it concerned the Royal Naval Air Service, was concentrated mainly on the submarine campaign against merchant shipping—a form of warfare that the enemy started on February 18 of that year. However, as already explained, our aircraft played but little part in the hunting of enemy submarines during 1915, chiefly owing to the fact that few of the seaplanes were capable of performing efficiently such an onerous duty.<sup>1</sup>

It was the airship branch of the German Naval Air Service that displayed the greatest activity during the year. No less than 20 raids were made on England, as a result of which 207 people were killed and 533 were injured.<sup>2</sup> The reasons that the Germans gave for the making of these raids were: interference with the manufacture and procurement of supplies and munitions—this was cited as the main reason; the infliction of damage on places of military value; 'to bolster up the spirit and moral of the Zeppelin crews assigned to scouting and patrol duty with the Navy';<sup>3</sup> to weaken our moral. Some enemy pilots have since admitted that in respect to this last object 'they failed. If anything, the British, in fact, Allied moral was considerably strengthened by the Zeppelin raids.'<sup>4</sup>

In addition to these raids the airships kept an almost continuous patrol over certain portions of the North Sea, and made no less than 389 long-distance patrols over that sea.<sup>5</sup> The enemy only lost one naval airship during the year—*L. 12* (on August 10)—which, it may be remembered, was brought down over the sea as a result of gun-fire from Langdon Fort, Dover.

In April of this year the first of the 'standardized' class of Zeppelin passed into the Service—the *L. 10's*. This class of airship was first used by the Army, the original one of the type being

<sup>1</sup> Vide *Naval Operations*, vol. ii, pp. 259–85; *Germany's High Sea Fleet in the World War*, pp. 215–58.

<sup>2</sup> Vide *The German Air Raids on Great Britain, 1914–1918*, pp. 265–6.

<sup>3</sup> Vide *The Zeppelins*, p. 39.

<sup>4</sup> Vide *ibid.*, pp. 38–41.

<sup>5</sup> *Ibid.*, p. 94.

*L.Z. 38.* The airship *L. 10* bore the works' number *L.Z. 40*. Ten airships of this class passed into the naval airship service, *L. 10* to *L. 19*. Their capacity was 31,900 cubic metres (1,126,000 cubic feet), and with four engines of 240 b.h.p. they could attain a speed of 98 kilometres (61 miles) per hour. Their static ceiling was 3,900 metres (12,800 feet); the gross lift was 36.4 tons, and the net lift 15.9 tons. These airships proved remarkably serviceable, and they were easy to handle on the ground. Particular attention was paid to the form and arrangement of the four gondolas and to their armament—more machine-guns and greater weight of bombs were carried than in the *L. 3* type.

Turning now to the air stations that directly opposed Great Yarmouth air station, Kapitänleutnant Bertram gave up the command of Borkum seaplane station on March 14, and his place was taken by Oberleutnant zur See Mans. This officer held the command till October 8, when he was succeeded by Oberleutnant zur See Tschirschky.

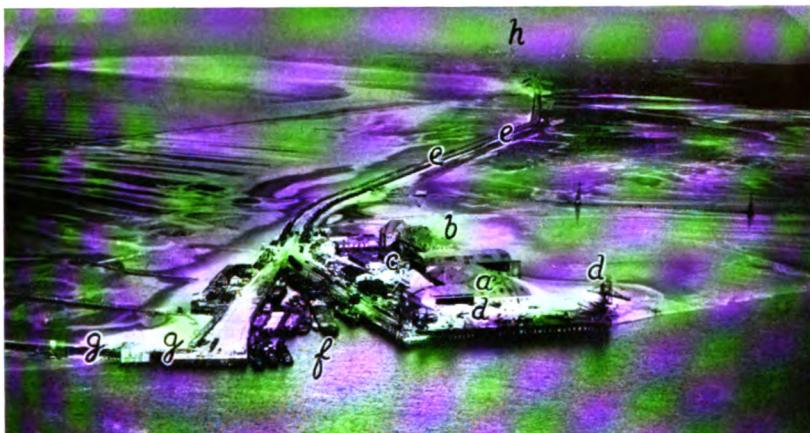
In January there were 3 machines on the station, but this number progressively increased till there were, at the end of the year, 13; and with this increase in the number of machines the number of the personnel grew. In order to house the officers and men the captured English steamer the *City of Bradford* was anchored in Borkum roadstead and converted into living-quarters. It is interesting to note that until August of this year Borkum air station was lit at night only by paraffin lamps—afterwards a small generating station was installed. In September, owing to the increase in the number of machines, work 'on the building of another massive hangar was started'.

Turning now to the flying operations conducted by the personnel of this station during 1915, the log-book shows that 802 'war patrols' were made. The smallest number—26—was made in November, and the largest—105—in August and September. The total number of machines lost during the year was 7. Two officers are recorded as missing and two were captured.

Some idea of the activity of this station may be gathered by this list of 'Principal Events' of the year, supplied by the German naval authorities:

- '1915. 19. 1. Battle cruiser of *Lion* class reported in 100 β.<sup>1</sup>
- 30. 1. Bombed submarine in 089 ε, the same in 117 ε.
- 11. 4. Sighted enemy submarine.

<sup>1</sup> See squared map of German patrols, facing p. 160.



BORKUM SEAPLANE STATION.

KEY.

*a*, Sheds.

*d*, Crane.

*g*, Target.

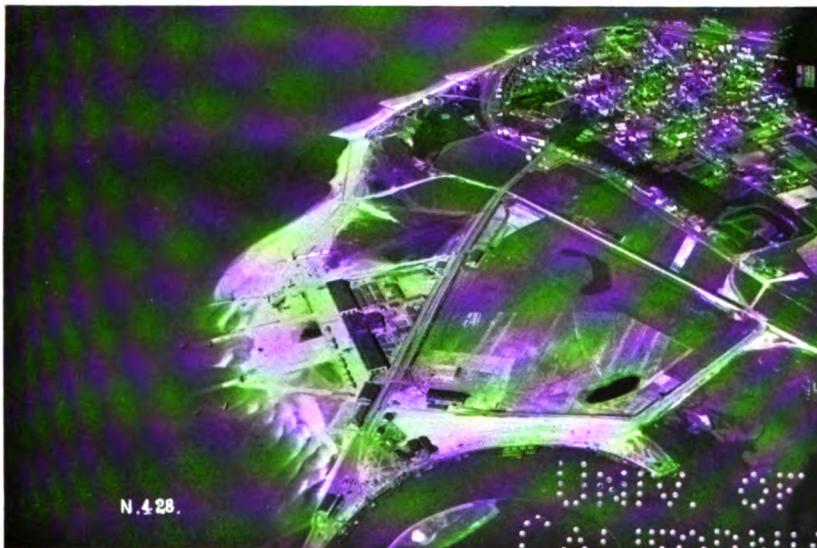
*b*, Mess.

*e*, Railway to Borkum.

*h*, The village of Borkum.

*c*, Engineering shop.

*f*, Harbour.



Norderney seaplane station, April 1918.

10. *W. M. G.*  
11. *W. M. G.*

1915. 14. 4. Dropped bombs on submarine, which dived quickly. Result doubtful.
26. 4. Found place of English minefield in 081  $\epsilon$ .
28. 4. In 098  $\epsilon$  bombed enemy submarine. In 108  $\epsilon$  dropped a 10 kg. bomb on spot where submarine had dived.
3. 5. In 098  $\epsilon$  dropped 2 10 kg. bombs on enemy submarine. Sighted one submarine in 092  $\epsilon$ .
4. 5. In 075  $\epsilon$  sighted enemy submarine. German submarine starting out was warned.
11. 5. In 045  $\epsilon$  bombed submarine. In 058  $\epsilon$  bombed submarine. Sighted four suspicious mine-layers or merchant steamers.
12. 5. Bombed the steamers sighted on the previous day in 022  $\epsilon$ .
23. 5. Saw in 036  $\epsilon$  2 small cruisers and 3 destroyers. Chased by 1 cruiser and 2 destroyers to 060  $\epsilon$ .
2. 6. In 037  $\epsilon$  met 1 enemy cruiser and 2 destroyers, a little farther north the same. Made two bombing attacks. Fired at with shrapnel. Made at least one hit on a destroyer, as was seen by the escape of steam.
20. 6. Saw 2 submarines; in  $\epsilon$  026 dropped bombs on quickly diving submarine, result doubtful. Saw fishing steamers which gave Morse signals with smoke and were probably co-operating with submarines.
25. 6. In 108  $\epsilon$  a seaplane on the water attacked by submarine with shell fire; splinters through floats. Submarine dived after starting.
3. 7. Bombed enemy submarine. Warned German steamer against it.
4. 7. Dropped bombs on submarine with no result. English seaplane over the Ems.<sup>1</sup> A bombing attack on Borkum hangars was repelled by machine-gun fire from the station. The return was cut off by own aircraft. The English machine flew over Dutch territory, broke out to sea at Schiermonnikoog and was there fired at by English seaplane with rifles. Pursuit had to be abandoned owing to superior speed of the adversary.<sup>2</sup>
- Sighted submarine. Dropped 7 bombs on diving spot, success possible.
5. 7. Dropped bombs on enemy submarine.
9. 8. In 034  $\epsilon$  sighted 5 enemy cruisers, dropped 5 bombs, effect not observed, enemy opened fire with shrapnel.
7. 9. Dropped 10 bombs on submarine. Result doubtful.

<sup>1</sup> Piloted by Flight Lieutenant H. Stewart.

<sup>2</sup> This note refers to some combined naval and aircraft operations made on that day in the Bight of Helgoland. Their object was the double one of bringing to action any enemy airships that were met and of reconnoitring the Ems River and the neighbourhood of Borkum.

1915. 11. 9. In 042 e sighted enemy destroyer. Dropped bombs on submarine.  
 14. 9. Dropped 10 bombs on submarine.  
 6. 11. Dropped 10 bombs on submarine.'

These constant references to attacks on our submarines are an unconscious tribute to the activity of these boats, as all these bombs were dropped on them when operating in the Bight of Helgoland.

One officer who served at Borkum seaplane station<sup>1</sup> has contributed the following note on the activities of this station during the year:

'From the air station at Borkum enemy forces were frequently seen and reported, and bombs were dropped on submarines. One submarine fired a torpedo at a German blockade runner near the Island of Juist, causing this ship to run ashore. As the submarine persisted in remaining in the neighbourhood, it was decided to set a trap for her, and a seaplane alighted on the water near her and sent off distress signals, with the object of making the enemy submarine rise to the surface. One of our submarines was to lie nearby and then torpedo the enemy one. The plan was carried out in so far as the English submarine came up, and at once opened fire on the seaplane, with the result that the latter could only start again with difficulty and the wings were hit by shell splinters. The German submarine which was to have come into action had, however, been delayed and was not yet in position, and so there was no result.

'On July 4 some light cruisers made a "push" against the Island of Borkum, and during these operations, at about 5 a.m., an enemy aeroplane passed the Island of Borkum in the direction of Emden. When it returned a quarter of an hour later, I went up to chase it, whereupon it turned off towards the west along the Dutch coast, while I kept near the coast of the Island. At the west corner of the Island of Ameland, the English pilot, on a northerly course, came down on the sea, and we met. Although I was flying the first 150 h.p. machine in the North Sea, the English pilot was considerably superior to me in speed. We fired at our adversary with rifles—we had as yet no machine-guns—but without success, while he flew over us once and dropped bombs at us. During the chase the petrol pipe in my engine broke, so that I made a forced landing. This took place in a rather thick ground-fog. While we were lying there and trying to repair the petrol pipe, an airship appeared, which was fired on without success by the enemy fleet, which, however, we could not see on account of the fog. After repairing the pipe, we were able to start again and return to Borkum unmolested. According to newspaper reports, the English pilot did not find his brother officers, but was picked up by Dutch fishermen.<sup>2</sup>

<sup>1</sup> Oberleutnant von Gronau.

<sup>2</sup> Flight Lieutenant E. J. M. Bird of the seaplane-carrier H.M.S. *Riviera*. He was picked up by a Dutch trawler and returned to this country 4 days later, for the

'At the end of 1915 and in 1916 no real fighting took place between English forces and the German air stations. But the seaplane division experienced serious losses of machines through engine breakdowns. These occurred in much greater number during the transition from 100 h.p. to 150 h.p. engines.'

At the beginning of 1915 Oberleutnant Maschinist Feuerhaak was in command of Norderney air station, but in February his place was taken by Oberleutnant zur See Edler, and by the end of the year there had been two other officers appointed to this command—in July Oberleutnant zur See Wedel and in November Oberleutnant zur See Mans.

During the first part of this year the personnel was engaged mainly in the development of the station itself. In April it was made into a school for pilots and observers, and did not become an active service station until the summer of 1917. During the year 1915 pilots only made 5 attacks on submarines of the Royal Navy, but on no occasion sighted any machines of the Royal Naval Air Service.

Oberleutnant zur See von Arnould de la Perrière remained in command of Zeebrugge air station until the December of 1915, when he was interned in Holland. On December 15 his place was taken by Kapitän Faber. During the year the work of building more sheds progressed, and better quarters were erected for the personnel. The average number of pilots on the station was 18 and the strength of the non-flying personnel grew from 75 in January to 191 in December, and the number of machines rose during this period from 6 to 14. During the whole of this year 818 'war patrols' were made with the loss of only two machines and two officers. No detailed account of the work done by this station during 1915 is available, but it is known that it consisted chiefly of inshore coastal patrols.

In May of this year a central workshop was built at Lisseveghe, near Zeebrugge. The function of this station was similar to our aircraft parks in France, in that it served as a base for the overhaul of all the machines, engines, and armament for the naval units operating in Flanders. It was under the direction of a very able engineer, Doktor Stein.

During this year the German Naval Air Service continued to rely for its North Sea coastal patrols chiefly on the Friedrichshafen

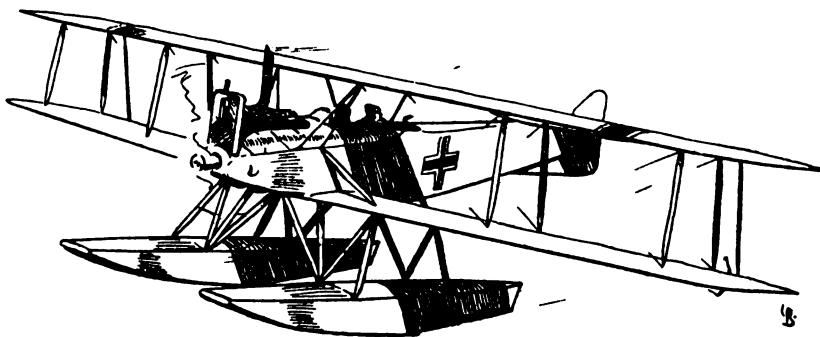
Dutch authorities regarded him as a 'shipwrecked mariner'. In his report of the part he played during these operations he makes no mention of having seen Oberleutnant von Gronau's machine.

seaplane equipped with the 100 b.h.p. Mercedes engine. Although it was not issued until early 1916, the same machine was equipped with the 120 b.h.p. and afterwards with the 150 b.h.p. Mercedes engine,

'which made it possible to carry enough petrol for 6 hours' flying, and also greatly improved the speed, climbing power, and seaworthiness of the machine.

'Particularly when attacks were made against submarines, 20 kg. of bombs could also be carried. But even this type was unable to carry out the most important duty of a seaplane—namely, rapid transmission of intelligence concerning hostile forces—for it was not capable of carrying a wireless installation. This was first made possible by the 150 and 160 h.p. engines. The reconnaissance machines working in the North Sea were then equipped with a wireless transmitting set, and later with a receiving set. Furthermore, anchors and driving anchors were supplied, tools and spare parts were carried, while a serviceable set of navigation and signalling instruments was installed. Also the performance in the air and on the water was greatly improved.'<sup>1</sup>

<sup>1</sup> *Die deutschen Luftstreitkräfte im Weltkriege*, p. 65. (English edition.)





GERMAN OFFICIAL PATROL CHART.



## XII

### THE ACTIVITIES OF GREAT YARMOUTH AIR STATION DURING THE YEAR 1916

A CONSIDERABLE amount of flying at night-time in B.E.2c's was done at Great Yarmouth air station during January 1916, because it was believed that the enemy were about to start an intensive campaign of airship raids. Owing to the amount of night-flying practices that were made, much experimental work was done with the intention of ensuring the safety of such flying, and it is interesting to read of one memorandum on the subject, which stated that:

'Certain struts and other parts of aircraft are to be made sufficiently luminous at night by being covered with luminous paint to assist in night flying and to avoid their being accidentally hit when firing at other aircraft. In many cases, in tractor machines, it would be desirable also to paint a small part of the tip of each propeller blade. All machines of which there is the slightest possibility of their being used at night should be so prepared, even although it is not intended to use them so normally or for practice purposes. In addition to the luminous paint, luminous string will, if possible, be supplied in place of the usual string as side slip indicator. Pending its supply, ordinary string, dipped in the luminous paint, must be used.'

Some idea of the difficulties of making safe landings at night-time at this period may be gathered from a letter written by an officer at the air station:

'When one goes up at night, flares are lighted on the ground so as to give you something to land by, and also to tell you the direction of the wind. They are placed across the aerodrome at about 440 yards apart. At the windward end of the line one flare is placed at right angles to the main line and 100 yards away, the whole lay-out making the shape of the letter L on the ground. The pilot has to approach the aerodrome from the top end of the L, travelling towards the shorter leg, but should land parallel to the longer leg. . . . It is an extraordinary thing, but sometimes from 5,000 feet one can see the flares beautifully: from 20 feet—the most critical time—the light becomes diffused, and one has not the least idea where one is, so one generally lands on a turn and crashes. . . .

'The peculiar difficulty about night-flying is judging distances. You think you are about 50 feet from the ground, when the ground suddenly hits you before you have time to "flatten out", and as a direct consequence, the machine flies straight into the ground, with disastrous results to the

machine. This is what nearly happened to me on one occasion. I thought I was about 25 feet up, when suddenly the ground rushed up at me. By great good fortune I managed to flatten out in time, and came safely to rest.'

This was, unhappily, not always the case, for the same officer records that:

'one of the pilots under instruction got mixed as to which was earth and which sky and flew straight into the ground, reducing his machine to matchwood. So certain were they that he was killed, that they did not hurry themselves unduly to his rescue, but procured stretchers and ambulances, &c. But on arriving at the scene of the disaster, they discovered him sitting up uninjured, with his head protruding through one of the main planes.'

During the early part of the year some pilots at the air station were supplied with a device which was designed to give them warning (when landing at night) of the proximity of the ground. In the words of one of the pilots this device:

'consisted of a string, with a weight at the end of it. The string was reeled out like an aerial while the machine was in the air, and hung about 50 feet below it. When the machine neared the ground the weight touched first, and the pull on the string released a catch which lit a red lamp and started a buzzer inside the cockpit.'

'This device was not popular. The weight generally hit a monument, or tree, and gave a false reading of one's approach to the earth. When, however, it did function correctly (sometimes the string was carried away altogether) the shock of the lighting of the red lamp and the starting of the buzzer on the pilot, whose nerves were screwed up to the last ounce in the process of trying to land, tended to raise the average of crashes rather than to lower it. I do not know that this ingenious invention has any history outside the museum of pious hopes.'

At this stage, in view of the fact that the year 1916 saw the height of the German airship campaign, it is considered desirable to give some account of the activities of the air station on the night of a raid. The following description was written about this time by one of the officers of the station:

'Our actual sleeping quarters are about one and a half miles from the actual sheds and the aerodrome. On about five successive nights now, just as we were sitting down to dinner, a Zeppelin would be reported approaching the coast somewhere on our beat. Result—a general "hoo-doo". All the pilots jump into cars and dash down to the sheds, closely followed by all the mechanics in lorries. As our way is right along the front, several cars and two 4-ton lorries loaded with men hurtling down to the air station frighten the whole of Yarmouth. On arriving down there our machines are put on

the Denes and engines tested—perhaps some unlucky fellow is sent up to do a patrol, the night being as black as pitch. . . . We all sit round the fire in the Officers' Quarters down there, waiting for news. Suddenly the telephone rings—an officer is wanted immediately on the 'phone—the others try to read the message by the look on his face. Then he announces that the Zeppelin is travelling north, east, south or west, anywhere but towards us—rather a relief.

'Or the other thing may happen—the roar of engines, every one getting rattled—and then up go the machines, racing backward and forward along the coast, searching the sky or the depths beneath them for any signs of enemy activity. Having stayed up for their appointed periods, the sky above the aerodrome is suddenly lit up by the firing of a Very light—the sign that the machine is about to come down. Almost instantaneous with the firing of the light, the inky night is illuminated by countless flares placed in two long lines the length of the Denes, about 150 yards separating the lines of blazing petrol. There is a roar and a whistling of wind and a machine glides and bumps to the earth between the two rows of fire, and almost before the machine comes to a standstill it is swallowed up in the night, the flares being doused with a surprising rapidity lest a Zeppelin should be attracted to the spot by the glare.

'This is a fairly detailed account of what happens when Zeppelins are near and machines go up. On occasions when they do not actually come near we sit down there waiting and waiting sometimes till dawn breaks for the telephone to blurt out its unwelcome message. I only wish I could give some of those blighters, who wrote to the papers asking what the R.N.A.S. is doing and if machines are up at night in full force, one short trip at night. . . . The feeling of absolute loneliness—no passenger being carried—is almost unbearable. Nothing to see save a thin gleam of silver where the waves break on the shore and give off a phosphorescent glint. If it was not for the compass it would be impossible to tell which was land and which was sea. Then the beastly descent, knowing that there is enough explosive beneath one, in the bombs, to blow up the air station. This, mercifully, has been changed, as now all bombs are to be dropped into the sea before landing. One such ride, even if it only lasted for ten minutes instead of two hours, would make these busybodies sit up and think twice before they asked questions on subjects they know nothing about! Still, after all, what we have to put up with is infinitesimal, when compared with what the poor devils in the trenches go through—and we try to remember this.'

In January a change took place in the command of the High Sea Fleet, for on the 8th Admiral von Pohl was taken seriously ill. He was operated on but never recovered, and died on February 23. Admiral R. Scheer was appointed to deputize for him, and on January 18 he was formally appointed to this command, for by then it was realized that von Pohl was dying.

Admiral Scheer has since stated that after taking over the com-

mand, his 'first and most important task was to draw up a plan for the future tactics of the High Sea Fleet and to work out a programme of operations'; for he realized that if Germany was to be victorious, then the Navy was to wage war 'far more energetically' than it had done during the previous sixteen months. He realized that the relative strengths of the Grand and High Sea Fleets hindered the latter from seeking 'decisive battle', and so his strategy was aimed at preventing a decisive battle being forced upon him. Admiral Scheer was adverse, however, to a policy of inaction, and determined that he would make us feel the 'gravity of the war', but before he could 'attempt an effective and far-reaching offensive' the German coastal waters must be so controlled that there was no fear of the German naval forces being surprised and made to fight a fleet action against their will and judgement.

The offensive measures against us that were decided upon 'were the U-boat trade-war, mines, trade-war in the North Sea and on the open seas, aerial warfare and aggressive action of the High Sea forces in the North Sea. The U-boat and aerial warfare had already started: the three other factors were to be operating in combination.'

Following upon this policy, 9 naval Zeppelin airships raided the Midland counties on the night of January 31. They were *L. 11*, *L. 13*, *L. 14*, *L. 15*, *L. 16*, *L. 17*, *L. 19*, *L. 20*, and *L. 21*. So large a number of airships had not raided this country hitherto, and they represented the total number of airships of the new standardized *L. 10* type then in commission. They appeared off our coasts in successive groups; the first group, *L. 13* and *L. 21*, appearing to the south of Cromer at about 4.50 p.m.

A few minutes later this information was sent to the commanding officer of the air station, and at 5.0 p.m. Flight Lieutenant Nicholl flew off in a B.E. 2c to the northward. Over Trippingham he encountered rain and mist and climbed to a height of 5,000 feet, flying over the neighbourhood of Mundesley and Bacton, but, as 'the visibility was nil on account of rain and mist', he landed at the night landing-ground at Bacton, after having been in the air for nearly an hour. Five minutes after he had left the aerodrome Squadron Commander Ireland also arose in a B.E. 2c, but he, too, was defeated by the weather and landed half an hour later. At 5.15 p.m. Flight Lieutenant Wood left Bacton night landing-ground (also in a B.E. 2c) and flew to the northward, passing

<sup>1</sup> Vide *Germany's High Sea Fleet in the World War*, chapter viii.

over the night landing-ground at Holt. Because of the rain and mist he lost his bearings, but despite this he went on flying in the fog and darkness for an hour and three-quarters. At the end of this time, having seen nothing of the enemy, he decided to land, but his engine suddenly stopped, and he was compelled to make a forced landing in the grounds of a house in Spixworth, a village about 3 miles north of Norwich. His landing has since been described by one of his brother officers, who said:

'He glided down till his altimeter said 0—and waited developments. Suddenly there was a rending crash—both wings of his machine crumpled up—and he sat down with a bang on the lawn of an old house occupied by two old maiden ladies. He had apparently glided down an avenue of trees, shorn off both wings and sat down just beyond them, absolutely unscratched.'

Just after Wood landed, Flight Lieutenant Chichester Smith also flew off in a B.E. 2c, but he, too, was defeated by the fog and later landed at Bacton night landing-ground.

After *L. 13* and *L. 21* crossed the coast they were followed by *L. 11* and *L. 20*, which came overland by way of the Wash at 7.10 p.m. It is understood that the German naval authorities had planned that this raid should be made against the Liverpool-Manchester-Sheffield district, and that the airships had been instructed to make their 'landfall' between the Inner Dowsing and Haisborough light vessels. The rain and mist that defeated our attacks against the enemy airships also threw them out in their course, and none of the airships ever reached Liverpool. Shrewsbury was the farthest westward point reached, and this was achieved by *L. 14* (Kapitänleutnant Böcker) which, incidentally, remained over this country for some 8 hours that night. Kapitänleutnant Loewe of *L. 19* surpassed this fine flight by 3 hours. He proceeded over the Midland area. Kapitänleutnant Mathy in *L. 13*, after crossing the coast south of Cromer, came over King's Lynn, and then passed over Derbyshire and Staffordshire, going as far north as Macclesfield and Buxton, and then out to sea just north of Skegness. Kapitänleutnant Dietrich in *L. 21* crossed the coast in company with *L. 13*, went over the Midlands, going out to sea south of Lowestoft, crossing the coast at 11.30 p.m.

Ten minutes after *L. 13* went out to sea, Squadron Commander Ireland went off again from the air station, in the blinding rain and mist, in a B.E. 2c, to attempt to attack *L. 21*, but was forced down by banks of heavy cloud and landed at the air station at midnight.

Of the other enemy airships *L. 20* (Kapitänleutnant Stabbert) crossed the coast over the Wash and reached Burton-on-Trent; then he turned back and went out to sea between Wells and Cromer. *L. 15* (Kapitänleutnant Breithaupt), *L. 16* (Oberleutnant Petersen), and *L. 17* (Kapitänleutnant Ehrlich) did not penetrate far inland; the first only came over Norfolk and Lincoln, and the two others merely skirted the coast.

Besides the pilots who went up from Great Yarmouth air station, many others arose from other air stations, but none was able to make contact with the enemy. The Royal Flying Corps had the misfortune to lose two officers that night—Majors L. da C. Penn-Gaskell and E. F. Unwin—who crashed on landing on account of the fog.

The enemy dropped 205 high-explosive and 174 incendiary bombs over various parts of the country, as a result of which 70 people were killed and 113 injured.<sup>1</sup>

The enemy airships, however, did not escape loss, for *L. 19* (Kapitänleutnant Loewe) ran short of petrol over Borkum (it will be remembered that she had stayed over this country for 11 hours) and was forced to alight at sea, after having been fired upon by the Dutch while drifting helplessly over Holland. *L. 19* floated in a damaged condition to the westward, and at 7.30 p.m., on February 2, she was sighted off Spurn Head by H.M. armed trawler *King Stephen*. The crew of the airship hailed the trawler and asked to be taken on board, offering her Master money if he would do so, but their request was refused by him because he was frightened that his ship might be seized by the numerically superior crew of the airship. He thereupon put about and steamed to the Humber to give his report. *L. 19* was never seen again, for she sank with the loss of all her crew.

Some months later, according to German accounts, a number of bottles was picked up in fishing-nets off the Norwegian coast. One of these contained a message written by Kapitänleutnant Loewe and addressed to Korvettenkapitän Strasser. It read:

'With fifteen men on the upper platform of the *L. 19* drifting in the North Sea. Had trouble with three engines and head winds, consequently delay until ran into fog and drifted over Holland. We were fired at considerably. Ship was hit and became heavy with the engines failing definitely. The 2nd of February about noon will probably be our last hour.'<sup>2</sup>

<sup>1</sup> For a detailed account of this raid vide *The German Air Raids on Great Britain, 1914-1918*, pp. 76-82, and *Germany's High Sea Fleet in the World War*, pp. 104-6.

<sup>2</sup> *The Zeppelins*, p. 118.

It should be said that the engines of this airship were of a new type with which considerable trouble was at first experienced.

While making allowances for the natural nervousness of the Master of the *King Stephen*, his behaviour had an unfortunate effect, for it enabled the Germans to say that we had violated the laws of humanity by allowing a body of men to perish who had previously surrendered.

In connexion with this raid Admiral Scheer has stated that:

‘Sometimes during the flight of the airships they would be obliged to deviate from their plan of attack for other reasons than wind and weather. Therefore all airships that went up were given a general order to attack England in the south, centre, and north. “South” signified the Thames, “Centre”, the Humber, and “North”, the Firth of Forth. These three estuaries were the main points of support for the English Fleet, and were amply provided with all kinds of naval and mercantile shipbuilding works. The direction of the attack, whether south, centre, or north, was determined by the wind, as the airships usually had the wind against them in going, in order, on the return journey, to have it behind in case they had to cope with damage or engine trouble.’<sup>1</sup>

The performances of the naval Zeppelin airships on the night of that raid may be of interest:

<i>Airship.</i>	<i>Base.</i>	<i>Total time in the air.</i>	<i>Total distance covered.</i>	<i>Maximum height reached.</i>	<i>Average speed.</i>
		hrs. min.	miles.	feet.	m.p.h.
<i>L. 11</i>	Nordholz	22 2	915	6,725	41·0
<i>L. 13</i>	Hage	20 45	870	9,850	42·0
<i>L. 14</i>	Nordholz	24 20	1,080	9,850	44·5
<i>L. 15</i>	Hage	22 20	1,070	9,350	51·5
<i>L. 16</i>	Hage	19 0	670	8,850	35·5
<i>L. 17</i>	Nordholz	20 30	805	9,200	38·6
<i>L. 19</i>	Tondern		Lost on return voyage.		
<i>L. 20</i>	Tondern	24 25	815	11,150	34·0
<i>L. 21</i>	Nordholz	23 48	1,050	9,200	44·5

This raid of January 31 was but one of many in which the weather prevented German airship commanders reaching their desired objectives. During the War the German Air Services were handicapped severely, when raiding this country, by the lack of accurate knowledge of weather conditions. Their most westerly meteorological station was at Bruges—which, by virtue

<sup>1</sup> *Germany's High Sea Fleet in the World War*, pp. 105 and 106.

of its position, was of little use in foretelling weather conditions over the United Kingdom, especially when westerly winds were blowing. The result of this handicap was, as one Zeppelin commander has remarked, that they 'were often compelled to set out blindly on flights which might last 20 hours'. The same officer has estimated 'that at least 30 per cent. of the flights towards France or England were interrupted by unforeseen weather changes'.<sup>1</sup>

Zeppelin airship commanders also suffered from lack of the 'normal aids to navigation' when raiding this country. It was too dangerous for them to use wireless telegraphy, except in the case of emergency, as its employment would indicate their position to us, and the towns and countryside were so darkened that it was difficult for them to recognize landmarks.

The airship navigators determined their drift by dropping flares and by observations on cloud movements, and, when operating from Belgium, by taking sights on two special light-houses that had been erected for the purpose at Ostende and at Steenbrugge. The straight line between these two beams of light extended directly across to the mouth of the Thames, and by keeping the lights in line, so long as they were visible, the navigators could determine the wind direction, at least during the first hour or so of the voyage.

To return to the affairs of Great Yarmouth air station, February was a sad month for the station, for three officers lost their lives. On the 16th Flight Sub-Lieutenants J. Page and B. R. Lee went out on a patrol in a Short seaplane and never returned. For several days afterwards the sea was searched by aircraft and by H.M. ships, but these two officers and their machine were never seen again. Presumably they had experienced engine trouble and were forced to alight, and thereafter were drowned, for a heavy gale had sprung up during the night.

Five days later the station lost its commanding officer, Squadron Commander Ireland, under tragic circumstances. It may be remembered that he and Wing Commander Usborne had been making experiments (in 1915) with a so-called 'airship-plane', and that the first trial with it in the air had been made in August of that year, when certain defects had been apparent. These were remedied, and the craft was ready for the first launching trial on February 21 (1916), when it was taken up by Squadron Commander Ireland and Wing Commander Usborne. The

<sup>1</sup> *The Zeppelins*, pp. 49-51.

ascent was made from Kingsnorth airship station, and when the craft had reached a height of about 4,000 feet, the B.E. 2c machine (which was slung underneath the envelope) was seen to drop. It fell away from the envelope in a side-slip, turned on its back, and one of the occupants was seen to fall out of his seat; it was Squadron Commander Ireland. He fell into the river Medway and his body was recovered by a lighterman. The machine crashed into the goods yard at Strood station, and Wing Commander Usborne was found dead, strapped in his seat.

The Court of Inquiry that sat to investigate the cause of the accident found that, owing to the craft having exceeded the 'equilibrium height', there was a resultant loss of pressure within the airship envelope, which brought about a premature release of the forward suspension. This support having been removed, the nose of the aeroplane fell forward (owing to the weight of the engine), with the result that an undue strain was placed upon the other two suspension wires, and they failed. As the B.E. 2c fell clear, there is reason to believe that the controls were damaged, otherwise, because of the inherent stability of the machine, it might have glided to safety.

So died two of the bravest men in the Royal Naval Air Service, and the Service was poorer because of their death.

Flight Commander Vincent Nicholl assumed temporary command of Great Yarmouth air station (he was First Lieutenant before this tragedy) until the posting, on February 28, of Squadron Commander Douglas A. Oliver. This officer was one of the first of the naval pilots, and, during the early days of the War, as already recounted, he had served as a Flight Commander at the seaplane station at Scapa Flow, and afterwards in the aircraft-carrier H.M.S. *Empress*. He took part in the raid on Cuxhaven on Christmas Day, 1914, and previous to commanding Great Yarmouth air station was the commanding officer of the seaplane station and experimental flight at the Isle of Grain.

Several other officers joined the station this month. Amongst them were Flight Lieutenant B. D. Kilner and Flight Sub-Lieutenants W. Arlingham-Davies, S. Kemball, and A. A. Reeves.

It was on the 16th of this month (February) that the War Office took over once more from the Admiralty the responsibility for the defence of London against hostile aircraft, and two months later this responsibility was extended to embrace the whole of the country. It will be remembered that this step had been fore-

shadowed in the conference between the Admiralty and the War Office, held in the July of the previous year.<sup>1</sup> However, this did not affect the duty of the Royal Naval Air Service of attacking hostile aircraft when found flying over the sea, and, in practice, machines of this Service always attacked the enemy when they approached within striking distance, so that no difference was made to the activities of Great Yarmouth air station in this field by this retransference of responsibility.

To conclude the account of the happenings at the air station during February, it may be remembered that on his appointment Admiral Scheer had decided upon 'aggressive action of the High Sea forces in the North Sea'. On February 9 the Admiralty warned Admiral Sir John Jellicoe, as well as Admiral Sir David Beatty at Rosyth, that the German Fleet was showing signs of activity. The next day it was known that a considerable force of cruisers and light cruisers was proceeding west from the River Jade. The Admiralty suspected that a raid was to be made on our east coast and Admiral Beatty was ordered south to cut them off as they returned, and Commodore Tyrwhitt was instructed to put to sea. They had scarcely started when the German torpedo boat flotillas II, VI, and IX, led by Kapitän Hartog, encountered, to the eastward of the Dogger Bank, our 10th Sloop Flotilla, which was engaged in sweeping operations. A sharp action followed, and one of the sloops—the *Arabis*—was sunk. The enemy suffered no loss, but on the return of the Harwich force, Commodore Tyrwhitt's flagship, the *Arethusa*, struck a mine, and, despite great efforts to save her, she drove upon the Cutler Shoal, broke her back, and was lost.<sup>2</sup>

The Admiralty ordered the personnel of Great Yarmouth air station to 'stand by' that night, and some idea of the ensuing events at the station may be gathered from the following excerpt of a letter written by an officer who witnessed them:

'On Friday night—the 11th—we were all awakened at 1.30 a.m., and told to beat it to the air station, as a squadron of our light cruisers had been repulsed and either a landing or bombardment was expected. We got all the machines ready, and spent the night testing engines, &c. Just before dawn we sent out the machines to scout around. It was blowing a half gale, and so only the larger seaplanes could operate. As my machine is very fast

<sup>1</sup> Vide *The German Air Raids on Great Britain, 1914-1918*, pp. 72-3; also *The Defence of London, 1914-1918*, chapter v.

<sup>2</sup> Vide *Naval Operations*, vol. iii, pp. 274-6; *Germany's High Sea Fleet in the World War*, p. 107.

and small, it needs a practically plumb-smooth sea to get off on, thus, as there was a fair-sized sea on, I could not go. Needless to say, nothing happened, as, on the approach of our cruisers, the Germans roared back.'

This was but one of the many occasions when the personnel of the air station was instructed to stand by to attack the enemy's naval forces, and that nothing more came of it.

Although the Germans had relied so far mainly upon their airships for raiding this country, they had made some aeroplane raids,<sup>1</sup> and on February 20 two of their seaplanes bombed Lowestoft and Walmer; the first town received 19 and the last 6 bombs. Unfortunately, one person was killed and one injured, although the material damage inflicted was small. As soon as the raid started the air station was informed, and certain pilots went off to attack the enemy machines. One of them was Flight Lieutenant Cadbury, who described his flight in the following letter, written a few days later:

'Just as we were coming out of Church, we got a message to say that two German seaplanes were dropping bombs over Lowestoft. We all immediately rushed down to the sheds, and Smith<sup>2</sup> and I pushed off in machines in pursuit. The War Office says that the Germans came back, but I know they did not; we were mistaken for Germans and fired on, at least I was, Smith was at 10,000 feet and practically invisible, I was at 4,000. We both went over Lowestoft together at 11.10 a.m., and there was no sign of any other machine; altogether we had 6 machines up, 4 within 12 minutes of the raid. . . . Smith and I went seaward in pursuit, but the Germans vanished into the clouds. It was simply terribly cold—I had no time to get ready and had not got any gloves; I have never been so cold before.'

On the night of March 31/April 1, 5 naval Zeppelin airships raided Lincolnshire, East Suffolk, Ipswich, and Essex. The airships were *L. 13* (Kapitänleutnant Mathy), *L. 14* (Kapitänleutnant Böcker), *L. 15* (Kapitänleutnant Joachim Breithaupt), *L. 16* (Oberleutnant Petersen), and *L. 22* (Kapitänleutnant Dietrich-Bielefeld). Two military airships are also believed to have formed part of the raiding force. During the whole of the raid not a single machine arose from Great Yarmouth air station, as nobody there knew that the raid was in progress. It was found afterwards that all telephonic and telegraphic communications had been cut, not only at this air station, but also at Cranwell and Felixstowe. It was never discovered whether this severance was

<sup>1</sup> Vide *The German Air Raids on Great Britain, 1914-1918*, pp. 205-11.

<sup>2</sup> Flight Lieutenant Chichester Smith.

accidental, or the act of enemy agents or ill-disposed persons, although rumours were rampant.

Eight pilots of the Royal Naval Air Service and nine of the Royal Flying Corps went up from other air stations to the attack that night, and *L. 15* was engaged by two officers of the Corps—Second Lieutenants A. de B. Brandon and C. A. Ridley—but they failed to bring her down in flames.

Altogether 223 bombs were dropped during this raid, which resulted in the killing of 48 persons and the wounding of 64. The enemy did not escape without loss, for, after *L. 15* had been hit by shrapnel (from the anti-aircraft guns at Purfleet) she lost so much of her buoyancy that she broke her back and fell, from a height of 2,000 feet, into the Thames estuary at Knock Deep, and her commander and crew were captured.

During March and April considerable 'liveliness' took place in the North Sea. Seaplanes from the *Vindex* attempted, on March 24, to bomb the Zeppelin airship sheds at Tondern, but the attempt was unsuccessful, chiefly on account of bad weather.<sup>1</sup>

The Grand Fleet tried also to goad the enemy to sea, and during the early part of April made two sweeps to the Norwegian coast, but sighted nothing of the enemy's fleet.

On the afternoon of April 24 news was received at the Admiralty that a rebellion had broken out in Ireland, that Sinn Fein was in possession of Dublin, and that there was reason to believe that the High Sea Fleet was about to put to sea.

At 6.0 p.m. that afternoon Admiral Sir John Jellicoe was informed that three hours earlier the enemy's battle cruiser fleet was 40 miles west of Helgoland, and apparently steering northwest, while his battle fleet seemed to be moving out in support.

In order to combat this move Admiral Sir John Jellicoe ordered Admiral Beatty and Commodore Tyrwhitt to take certain steps, so that their forces (including submarines from Great Yarmouth) should be concentrated in areas in which the enemy would be likely to move. Aircraft were also ordered to scout at daybreak.

It is not known why Admiral Scheer chose this moment for this operation; in the account he himself gives no mention is made of the Irish Rebellion, and the reasons that he assigns are not reconcilable with the facts. In his own words:

'On April 24, Easter Monday, the Fleet put out on an important enterprise which, like that in the beginning of March, was directed towards the

<sup>1</sup> Vide *The War in the Air*, vol. ii, pp. 397-401.

Hoofden,<sup>1</sup> but was to be extended farther so as to force the enemy out of port. I expected to achieve this by bombarding coastal towns and carrying out air raids on England the night the Fleet went out. Both these actions would probably result in counter measures being taken by the enemy that would give our forces an opportunity to attack. . . .

'Lowestoft and Yarmouth were the only coastal towns it was intended to bombard. Both were fortified and were important military points of support for the enemy—Lowestoft for mine-laying and sweeping; Yarmouth as a base for the submarines, whence they started on their expeditions to the Bight. The destruction, therefore, of the harbours and other military establishments of both these coastal towns was a matter of great military importance, apart from the object of the bombardment in calling out the enemy.'<sup>2</sup>

At noon on the 24th the whole German force, including airships, left their bases, and two hours later the battle cruiser flagship *Seydlitz* (Admiral Bödicker) struck a mine, thus preventing her from taking part in the operations. She returned to harbour under her own steam, escorted by the airship *L. 7*.

The movements of the enemy's airships should now be followed. Those accompanying the fleet were 7 in number: *L. 11*, *L. 13*, *L. 16*, *L. 17*, *L. 20*, *L. 21*, and *L. 23*.<sup>3</sup> Three older airships—*L. 6*, *L. 7*, and *L. 9*—accompanied them 'to hold themselves in readiness . . . in the rear of the fleet for reconnoitring', but these returned to their bases next day, after coming some of the way over the North Sea. *L. 7*, as already stated, escorted the damaged *Seydlitz* back to harbour. The main object of the airships was to reconnoitre for the fleet—raiding was but a secondary consideration. Six of them did, however, cross the coast—one made for Lincolnshire, four for Norfolk, and one for Suffolk. A total of 107 bombs was dropped that night. Practically no damage was done, and the only casualties were the death of an aged woman (from shock) and the injury of a man.

The presence of these airships was known at the air station on the night of the 24th, and just after 10.30 p.m. Flight Sub-Lieutenant F. W. Walker flew off in a B.E. 2c to look for them, and though he remained in the air for an hour and a half, he saw nothing of the enemy. He landed at Sedgeford night landing-ground just after midnight. A short time afterwards there ascended in B.E. 2c's three other officers—Flight Sub-Lieut-

<sup>1</sup> The 'Hoofden' or Flanders Bight corresponds to our southern area, that is, the portion of the North Sea which narrows down south of the Wash—Terschelling line between the coasts of East Anglia and Holland.

<sup>2</sup> *Germany's High Sea Fleet in the World War*, p. 124.

<sup>3</sup> *L. 14* had to return on account of engine trouble when off the River Jade.

tenants Reeves, Fane, and Pulling. Descending just after midnight, the two first named landed safely, but the third crashed, fortunately without injury to his person. They, too, had not sighted the enemy. The next morning, shortly before 3.0 a.m., Flight Sub-Lieutenant S. Kemball went off in pursuit of a Zeppelin airship, but failed to make contact and, returning, landed an hour later at Covehithe night landing-ground.

Dawn was breaking on the morning of the 25th when the enemy appeared hull down off the coast and opened fire on Lowestoft and Great Yarmouth. About 3.45 a.m. a hostile airship, *L. 13* (which appeared to be spotting for the fire of the enemy's battle cruisers), was sighted from the air station, and Flight Commander Nicholl immediately started in pursuit, this officer being followed one minute later by Flight Lieutenant Hards, both in B.E. 2c's. They chased the airship for 65 miles out to sea, being subjected part of the time to machine-gun fire from the gun position in the tail of the airship. Nicholl used to say, in after years, that he would be able to recognize the German officer who, standing in the after gun-pit, coolly scrutinized him and his machine through his binoculars. Both Nicholl and Hards managed to fly above *L. 13*, and one after the other they attacked her with bombs and Ranken darts, but were unsuccessful in their attempts at destruction. They remained in the air for nearly two hours, and eventually landed at the air station.<sup>1</sup>

About 4.0 a.m. three other officers, Flight Lieutenants Chichester Smith, Kilner, and Wood, in Bristol Scouts, and Flight Sub-Lieutenant S. C. Beare in a Sopwith machine, flew off for the purpose of attacking another Zeppelin airship which had been sighted, but she ascended into the clouds and so managed to escape.

The enemy's fleet was not allowed to go unattacked by pilots from the air station. At 4.5 a.m. Flight Sub-Lieutenant H. G. Hall with Flight Sub-Lieutenant D. C. Evans (as passenger) in a Short seaplane (*No. 3108*) flew over the hostile ships at a low altitude, and, despite heavy and accurate gun-fire, dropped bombs. Flight Sub-Lieutenant Hall was severely wounded in the right shoulder and the machine badly damaged, but her pilot remained in the air for three-quarters of an hour and then succeeded in alighting with his machine before collapsing through loss of blood. When it is stated that he was classed as an 'officer under training' his feat was all the more remarkable. Immediately after 4.30 a.m. 5 more officers attempted to bomb the

<sup>1</sup> They also saw and chased another airship (*L. 16*) for a short while.

enemy's ships—Squadron Commander Oliver in a Short seaplane, Flight Lieutenant Chichester Smith and Flight Sub-Lieutenants B. S. Wemp and E. B. Thompson in B.E. 2c's. Flight Sub-Lieutenant G. H. Bittles ascended in a Short seaplane, but was forced to return on account of engine trouble.

Squadron Commander Oliver distinguished himself by the way in which he attacked the enemy with bombs. Speaking of this attack, one of his officers said:

'They fired at Oliver continuously, and those who saw him say it was like hell let loose, for sometimes his machine was simply covered from view by the enormous and accurate quantity of shrapnel shells, yet, by some miracle, he escaped without a scratch, as also did his machine.'

Despite these gallant attempts, the enemy's ships do not appear to have been hit, and shortly afterwards they turned about and proceeded home at a high speed. Although our naval forces made strenuous attempts to engage them, they failed to do so, because the enemy's one desire seems to have been to return as soon as possible to their bases.<sup>1</sup>

From the material side enemy shell-fire wrecked about 200 houses in Lowestoft, including the head-quarters of the commodore (Commodore A. Ellison), with happily but little loss of life; Great Yarmouth was hardly touched, but one shell fell into a big fish store on the Denes and blew thousands of fish barrels and baskets into the air—'a most exhilarating sight', as one officer of the station recorded.

His Majesty the King was pleased to decorate certain officers at Great Yarmouth air station for the services they rendered during these operations. Squadron Commander D. A. Oliver was appointed a Companion of the Most Honourable Distinguished Service Order, and the Distinguished Service Cross was awarded to Flight Commander Vincent Nicholl, Flight Lieutenants F.G.D. Hards and H. G. Hall, and Flight Sub-Lieutenant D. C. Evans. Flight Lieutenant Chichester Smith was also awarded the Distinguished Service Cross for his attack on a submarine.

A touch of humour was added to the affair by the adventures that befell the paymaster of the air station. This officer (Assistant Paymaster C. S. Nunn), who had recently joined the air station 'from the *very light cruiser Blonde*', was

'a painful casualty on the morning of the bombardment. I was on my despatch running trip to Lowestoft on a T.T. Douglas I had bought from

<sup>1</sup> Vide *Naval Operations*, vol. iii, pp. 300-9.

Fane—it was the pride of my life—and when doing about 50 I came round a bend and ran into some telephone wires brought down by shell fire and festooned across the road. I took a complete somersault and sat violently down in the road. I was in pyjamas and a British warm, and the fall took the whole of the seat of my trousers off. I sit down gingerly to this day when I remember the effect of this fall. I knew the way to H.Q. at Lowestoft (a pavilion on the pier) with my eyes shut. The propriety of interviewing a Commodore with no seat to my trousers and no underclothes and an abbreviated British warm so occupied my thoughts that I never looked up till I reached the door of the Pier Pavilion. Then I glanced up. A shell had hit H.Q. and made a nasty mess of the inside. A party of sailors were sweeping H.Q. through its own door and a dusty and enraged Commodore was standing just outside. It was too much for my much-tried trousers. I saluted, and the action was sufficient to loosen the already battered string. Slowly the garment left my waist and slid down to my ankles—!

The performances of the various German airships that day may be of interest:

<i>Airship.</i>	<i>Base.</i>	<i>Total time in the air.</i>	<i>Total distance covered.</i>	<i>Maximum height reached.</i>	<i>Average speed.</i>
<i>L. 11</i>	Nordholz	23 15	695	7,700	31·0
<i>L. 13</i>	Hage	15 55	560	10,200	37·8
<i>L. 16</i>	Hage	16 0	680	11,150	55·0
<i>L. 17</i>	Nordholz	21 11	765	8,200	37·0
<i>L. 20</i>	Tondern	17 50	805	7,700	46·0
<i>L. 21</i>	Nordholz	21 3	870	10,250	41·5
<i>L. 23</i>	Tondern	16 41	800	7,500	44·5
<i>L. 14</i>	Had to turn back at Wangeroog on account of engine trouble.				
<i>L. 6, L. 7, L. 9</i>	employed on reconnaissance.				

The month of May was one of the most important in the whole War from the naval aspect, for during the month the attack on the Zeppelin airships at Tondern was made and the Battle of Jutland was fought. Arising out of the operations against Tondern, the Zeppelin airship *L. 7* was shot down by a round from a 6-inch gun fired by the light cruiser *Galatea*. Her destruction was completed by the submarine *E. 31*, which afterwards rescued the seven survivors of the airship crew of thirty.<sup>1</sup>

On May 31 the Battle of Jutland was fought—the first and only time in the War that aircraft took part directly in a fleet action. The seaplane-carrier *Engadine*, which was in station about the middle of the light cruiser line of the First Battle

<sup>1</sup> Vide *The War in the Air*, vol. ii, pp. 402-3.

Cruiser Squadron (Admiral Sir David Beatty), sent up a Short seaplane, the pilot being Flight Lieutenant F. J. Rutland and the observer Assistant Paymaster G. S. Trewin, R.N. The latter officer was afterwards to serve at Great Yarmouth air station, and the former to be responsible for the staff work in connexion with its disbandment. These officers were able to report the course and disposition of the enemy's battle cruisers, although their view was obscured by mist. Flight Lieutenant Rutland was afterwards compelled to alight, owing to a broken petrol pipe in the machine, which he repaired by using a piece of rubber piping torn from his life-saving waistcoat.

Admiral Sir John Jellicoe, in his Battle of Jutland dispatch, speaking of this flight, states that, owing to 'clouds it was necessary to fly very low, and in order to identify four enemy light cruisers the seaplane had to fly at a height of 900 feet within 300 yards of them, the light cruisers opening fire on her with every gun that would bear. This in no way interfered with the clarity of their reports, and both Flight Lieutenant Rutland and Assistant Paymaster Trewin are to be congratulated on their achievement.'<sup>1</sup>

His Majesty the King appointed Flight Lieutenant Rutland a Companion of the Most Honourable Distinguished Service Order and awarded the Distinguished Service Cross to Assistant Paymaster Trewin for services rendered during this action. The first-named officer was also awarded the Albert Medal (First Class) for jumping into the sea and rescuing a wounded seaman.

To return to the affairs of the air station, during May and June a great deal of flying was done, particularly on anti-submarine and hostile aircraft patrols.

On July 12, for the first time during the War, an enemy submarine was sighted by a pilot from the air station. At 11.0 a.m. that day Flight Lieutenant Kilner, with Air Mechanic Money as his passenger, left in a Short seaplane on a submarine patrol to the Outer Gabbard light vessel. After they had been flying a short time they sighted an enemy submarine travelling awash about half a mile to the north-east of the Smith's Knoll pillar buoy. As soon as those aboard the submarine saw the seaplane, they 'crash-dived' the boat, and a few seconds later the seaplane flew over the presumed position of the submarine and dropped her bombs. No sign of wreckage was seen, but the seaplane circled the vicinity of the buoy for three-quarters of an hour,

<sup>1</sup> For a detailed description of the part played by aircraft during the Battle of Jutland vide *The War in the Air*, vol. ii, pp. 404-15.

and Kilner, seeing nothing, returned to the air station, dropping on his way a message to some trawlers he saw near the Cross Sands light vessel, giving them an account of his attack and the last-known position of the submarine.

July was blessed with good weather, and much flying was done. A typical 'Flying Report' of the day reads as follows:

- '4.35 a.m. Seaplane 3104 (Short). Pilot: Flight Sub-Lieut. Smith. Passenger: C.P.O. Heywood left on submarine W/T patrol to Smith's Knoll light vessel. Returned 7.5 a.m.'
- '9.5 a.m. Aeroplane 1194 (B.E. 2c). Pilot: Flight Lieut. Wood on local flight. Returned 10.12 a.m.'
- '11.0 a.m. Seaplane 8370 (Short). Pilot: Flight Lieut. Wood on patrol to Cross Sands and Shipwash light vessels. Returned 2.0 p.m.'
- '11.5 a.m. Seaplane 8368 (Short). Pilot: Flight Lieut. Hards. Passenger: Sub-Lieut. Thompson, R.N.V.R., left on patrol to Smith's Knoll pillar buoy. Not yet returned, presumably fog bound.'
- '11.5 a.m. Seaplane 3736 (Sopwith). Pilot: Flight Sub-Lieut. Fane on submarine patrol. Returned 11.21 a.m.'
- '11.30 a.m. Seaplane 8370 (Short). Flight Lieut. Cadbury left on patrol Smith's Knoll pillar buoy, Jim Howe, Haisborough light vessel, Cromer Knoll, Cross Sands light vessel. Returned 2.0 p.m.'
- '3.0 p.m. Aeroplane 1155 (B.E. 2c). Pilot: Flight Sub-Lieut. Galpin on local flight for bomb and Véry Light practice. Returned 3.20 p.m.'
- '3.0 p.m. Aeroplane 8417 (B.E. 2c). Pilot: Flight Lieut. V. Nicholl left for Burgh Castle on bomb-dropping practice flight. Returned 4.25 p.m.'
- '3.49 p.m. Aeroplane 1155 (B.E. 2c). Pilot: Flight Sub-Lieut. Northrop on local bomb-dropping practice. Returned 4.07 p.m.'
- '4.30 p.m. Aeroplane 8419 (B.E. 2c). Pilot: Flight Lieut. Smith. Passenger: Commander Hodgson (S.N.O. Yarmouth); local flight. Landed 4.55 p.m.'
- '5.58 p.m. Seaplane 8637 (Short). Pilot: Flight Sub-Lieut. Hobbs. Passenger: A/M. Haines on submarine W/T patrol to Cross Sands and Shipwash light vessels. Returned 7.0 p.m.'

In addition to these patrols there were always 'Duty Pilots' at each of the night landing-grounds.

Only one enemy airship raid was made during May and none in June, but at the end of July the German naval authorities launched a great airship offensive against this country. The three months of respite had been due to various causes—the two principal ones being that the summer nights were not long or dark enough, and that airships of the new *L. 30* class were not ready until the middle of the summer.

On the night of July 30 Zeppelin airships were reported off the coast near Wells-next-the-Sea, and pilots went off to attack them

from the air stations and night landing-grounds at Killingholme, Holt, Bacton, Great Yarmouth, Covehithe, and Felixstowe, but failed to make contact with the enemy, who did not cross the coast.

At 5.15 a.m. the next morning, Flight Sub-Lieutenant J. C. Northrop flew off in a B.E. 2c from Covehithe. He sighted a Zeppelin airship and pursued and attacked it when about 30 miles out to sea from Southwold. When about 1,500 feet below the airship, he fired two trays of explosive and tracer ammunition from his Lewis gun into her but with no visible result. He started to reload his gun (which was mounted on the top plane of his machine), and whether his hands were numbed with cold or he was over-excited is not known, but the tray flew out of his hand (when full of ammunition it would weigh some pounds) and struck him on the forehead. He was stunned and lost control of his machine, and when he recovered from the immediate effects of the blow the airship had disappeared in the clouds and Northrop never saw her again. Two other Zeppelin airships were reported over the air station that morning, but ground fog prevented any action being taken against them.

The following night (31st) 10 enemy naval airships left their sheds to raid this country. Two of them turned back, but the remainder continued their journey. Of these, *L. 16* reached Newark and dropped bombs at various points, but produced no casualties. Another airship came over Thanet, while the others went over East Anglia and Cambridgeshire. All together 100 bombs were dropped, but with slight material damage, and no casualties beyond injury to a horse and two bullocks. Many machines from the air station arose to the attack, but were prevented from achieving success owing to the fog. Flight Lieutenant Cadbury actually flew over one airship but failed to destroy it, for the reasons given in the account written by him a few days later:

'On Tuesday I went over to Bacton to instruct some pilots in the art of night flying, and also for night duty. Just before dusk I got an order to go up immediately. I patrolled up and down the coast for about two hours and landed at about 10.30 by the aid of flares. Unfortunately, my petrol pressure system was all wrong, and I had great difficulty in keeping my engine supplied. On landing I took the whole system adrift, but failed to find the cause of the trouble. I was in the act of putting it back when I heard the roar of a Zeppelin approaching from the sea. In a few minutes she hove into sight and sailed right overhead. She was picked up by the searchlights and a couple of guns managed to get off eight rounds at her. . . .

'On sighting the Zeppelin I crammed everything into its place, and jumping into my machine strapped myself in and prepared to fly in pursuit. But the presence of this enormous Zeppelin slick overhead so excited the mechanics that they could not get my engine started, so I had to unstrap myself, hop out, start my engine myself, and settle in my machine again. All this naturally took time, and when I finally got off, the Zeppelin had disappeared southward. I chased about for two and a half hours in the pitch dark looking for them, and trying to engage them as they were recrossing the coast-line, but I could not see them. My pressure system caused me trouble the whole time I was up, and I had to use the hand pump the whole time I was up, which proved very trying. I must have passed right over a Zeppelin as it was going back, but owing to the mist and darkness I could see nothing below me....

'Several of our seaplanes attacked the Zeppelins, breaking up their formations, and driving them off their course, so when they finally reached inland they had no idea of their position, and so unloaded all their bombs into fields.'

The next night, August 2, another raid was made, this time by 6 naval airships, all of which crossed the coast (one pilot said that during this particular week 'it rained Zeppelins'). Four of these airships never went farther than Norfolk and Suffolk; *L. 31* cruised over Thanet, while *L. 21* (which crossed the coast at Wells-next-the-Sea) dropped some bombs on the aerodrome at Thetford, then turned east and came over Covehithe, dropping 4 bombs near the night landing-ground, afterwards passing out to sea. *L. 11* flew over Harwich and is believed to have been hit by the fire from naval guns. *L. 21*, when over Burgh Castle, was engaged by Flight Lieutenant E. L. Pulling, who was in a B.E. 2c. He managed to get under her and emptied a tray of Lewis gun ammunition into her with no visible result. While reloading his gun he lost sight of the airship in the darkness and mist, and she escaped.

Flight Lieutenant Galpin also attacked an enemy airship, but had not the good fortune to destroy her. He described his adventures of that night as follows:

'I left Yarmouth at 7.15 p.m., and chased the Zeppelin at 6,000 feet for about 25 miles northward without bringing her into action. The light and my petrol both failed at 8.45 p.m., but I was fortunate to descry a ship and alight near her before the petrol petered out. As I alighted alongside the vessel, a guttural voice hailed me from the bridge in some unknown but apparently teutonic language. I put the machine down at the bow of the vessel and, as I drifted rapidly past, shouted to them to throw a rope.'

'Again a guttural voice replied and I made up my mind that this was undoubtedly the Zeppelin's mark ship, for we always understood that the

Zeppelins laid a course along the Dutch Islands as far as Terschelling light to ascertain their drift; prolonging this line with the calculations thus made, they arrived at Bacton on the Norfolk coast. We also thought at one time that they sent a merchant ship to anchor somewhere off Bacton and display a light when required. This is, I think, less probable, as their navigation would not have been inferior to ours and we had never any difficulty in making the opposite coast.

'Feeling sure that I had struck this mark ship, I hastily undid my various flying garments and destroyed every paper (except cash) which I had on me and prepared myself for capture and imprisonment. Two boats were put off rapidly from the ship and came down the tide towards me. I was standing rather dismally in a dishevelled flying-suit when they came up with me and at that moment one of the boat's crew, moved by my miserable appearance, cried heartily, "Good Lord! It's Charlie Chaplin."

'My relief knew no bounds. The ship was a Belgian vessel, S.S. *Albertville* (Captain J. Bernaerts) from the Congo, carrying a mixed crew. Unable to tow the seaplane against the tide, those fellows stood by me in an open boat from 9 o'clock to 4 o'clock in the morning, when they managed to get both me and the seaplane in board with so little damage that after arriving at Grimsby on the following day, I was able to take off and return to Yarmouth.'

On the second anniversary of the outbreak of war there were 35 officers at the air station and the night landing-grounds, 33 of whom were flying officers, all under the command of Squadron Commander D. A. Oliver, D.S.O., with Flight Commander Vincent Nicholl, D.S.C., as his First Lieutenant.

Apart from those directly mentioned in the foregoing text, the following officers were serving on the station during this month: Flight Sub-Lieutenants E. B. Thompson, A. Gammon, J. W. Hobbs, A. N. Robinson, H. B. Smith, N. H. McDiarmid, and C. H. M. Chapman. There were five 'specialist' officers, all of whom were sub-lieutenants, Royal Naval Volunteer Reserve—A. N. Pennel, the meteorological officer—the gunroom referred to his duties as consisting of 'sending up penny balloons at tuppence a time'; V. H. Ridewood, the armament officer; J. H. Dunn, officer in charge of the motor-boats; A. E. Siddons-Wilson, the engineer officer; and J. E. Maxwell and D. R. W. Thompson. The station had by now its own paymaster—Assistant Paymaster D. J. Lewis, R.N.R.—and there were also two naval warrant officers, L. R. Staddon and A. H. Davies.

Lieutenant F. W. Hodges, as in 1915, was the officer in charge of the night landing-grounds.

There were now 46 machines on the station, including 3 at the

night landing-grounds; and out of this total there were, on this date (August 4), some 13 'out of service'.

It is necessary to stress what an effect the loss of such machines (even though it was only temporary) had upon the operations of the station, or indeed, any flying unit; for it was, and is, essential to provide, by means of a reserve, against the loss by enemy action or crashing, and such a reserve must be available to make good quickly any losses. It is well to indicate what were the causes for machines being 'out of service'. For example, on August 7, 1916, the report of 'Aircraft not ready for service, with a brief statement of what defects to aircraft and their engines are in hand', reads:

'1151 (B.E. 2c)	Ready.	Allocated to Chingford.
1155 "	" Under repair.	
1160 "	Ready. Allocated to Eastbourne.	
8326 "	Awaiting new Raf engine.	
8418 "	Wrecked 3/8/16.	
8492 "	Wrecked 1/8/16.	
8614 "	Shifting gun mountings. Should be ready 9/8/16.	
1252 (Bristol).	Planes being re-covered.	
1256 "	Allocated to Cranwell.	
3105 (Short seaplane).	Engine trouble. Should be ready 8/8/16.	
3109 "	Controls frayed. Should be ready 9/8/16.	
8222 "	Engine removed for overhaul.	
8368 "	Engine under overhaul.	
8385 "	New chassis strut being fitted. Should be ready 9/8/16.	
8389 "	Fitting bomb racks. Should be ready 9/8/16.	
8164 (Sopwith).	Completely wrecked.'	

During this month (August) there was a considerable increase in the number of anti-submarine patrols made, and on the 19th two very long ones were made in Short seaplanes: the first, by Flight Lieutenant Kilner (with Chief Petty Officer Heywood as his passenger) and the second by Flight Lieutenant Galpin and Chief Petty Officer Rose. The former flew in the area bounded by Smith's Knoll pillar buoy and the Swarte Bank and the North Hinder light vessels, remaining in the air for 4 hours and 25 minutes; while the latter made a patrol of 6 hours and 10 minutes duration to the Texel and back.

On the evening of the 18th the High Sea Fleet put to sea, with the object, so Admiral Scheer has stated, of bombarding

Sunderland. He hoped also to draw the Grand Fleet, if it intervened, into his submarine flotillas.<sup>1</sup> His main flotilla of seven submarines was disposed in two lines on what he believed would be the tracks of the Grand Fleet, that is, one off Blyth and one off the Yorkshire coast. Twelve boats were stationed also off the Flanders coast.

Eight Zeppelin airships were disposed in various parts of the North Sea. *L. 30*, *L. 32*, *L. 24*, and *L. 22* were ordered to patrol between Peterhead and the southern extremity of Norway in order to watch the movements of the Grand Fleet. *L. 31* was stationed off the Firth of Forth, so that she could report any activity shown by the Battle Cruiser Force, under Admiral Beatty; *L. 11* patrolled off the Tyne; *L. 21* off the Humber; while *L. 13* kept watch off Harwich and over Vice-Admiral Tyrwhitt's Cruiser Force.

All these movements were known to the Admiralty in Whitehall, and during the forenoon of the 18th the Grand Fleet was ordered to rendezvous in the 'Long Forties'; the Battle Cruiser Fleet to join farther south; the Harwich Force to move to the eastward of Great Yarmouth, and twenty-six submarines were spread in various positions to intercept the enemy. The various naval air stations on the east coast were ordered to 'stand by'.

The operations on the next day (the 19th) were heralded by intense submarine activity on both sides. At 5.5 a.m. the German battleship, the *Westfalen*, was struck by a torpedo fired from *E. 23*, but she managed to reach the Jade under her own steam. An hour later the light cruiser *Nottingham* (which was one of the advanced screen of light cruisers to Admiral Beatty's battle cruisers) was hit by two torpedoes fired from *U. 62*—she was hit again at 6.25 a.m. and sank at 7.10 a.m. At first it was thought she had struck a mine, and Admiral Jellicoe, fearing that an unknown mine-field existed, considered 'it prudent to avoid this locality, and course was accordingly reversed, until it was ascertained that the damage was due to torpedoes; when this became clear, the southward course of the Fleet was shaped to pass to the eastward of the submarine'.<sup>2</sup>

Four hours in all were lost by this manœuvre, but it cannot be said, however, that it was the cause of preventing battle between the opposing fleets,<sup>3</sup> for an accident of a different kind was to

<sup>1</sup> Vide *Germany's High Sea Fleet in the World War*, p. 180.

<sup>2</sup> *The Grand Fleet, 1914-1916*, p. 439.

<sup>3</sup> Vide *The World Crisis, 1916-1918*, Part II, p. 163.

intervene, for, just after noon, *L. 13* reported strong British forces about 70 miles to the southward, and that these had been coming north at 11.30 a.m. These ships were the Harwich Light Cruiser Force, but Admiral Scheer thought it was the Grand Fleet, and that his retreat was compromised.<sup>1</sup> He, therefore, turned completely about and, after waiting for his battle cruisers to get ahead of his fleet, steered for the Jade. He was followed hotly by the Grand Fleet, but they failed to catch him, and so turned reluctantly homewards, losing, on the way, the cruiser *Falmouth* by a torpedo fired by a German submarine. The Harwich Force did sight—at 6.0 p.m.—the retiring enemy, but the Grand Fleet was too far off to offer any support, and so, an hour later, Admiral Tyrwhitt turned for his base and the operations came to an end.

The part that Great Yarmouth air station played during the affairs of these last two days was recorded at the time by one officer of the station as follows:

'On Friday the German High Sea Fleet was reported out and so we had to stand-by all Friday night awaiting for the dawn, which comes so confoundedly slowly, before we were able to send out wireless patrols. Two went over to Holland and flew up and down the Dutch coast but saw nothing. So we have been up 48 hours. . . .

'I have just found out why we were kept at it for 48 hours expecting the German battleships to attack any minute. The signal to resume normal conditions was sent out from London at 8.15 p.m., last night.<sup>2</sup> They forgot to notify Yarmouth area, so that the Navy and the Army were standing-by ready for instant action all night without cause, the latter manning the trenches in the rain. We were finally told this morning!<sup>3</sup>'<sup>3</sup>

It is interesting to note that Admiral Scheer blamed the commanders of the Zeppelin airships for part of the non-success of this operation, for he wrote subsequently that:

'The reports from the airships were not entirely reliable, chiefly because they were only eight in number and were expected to keep such a large area in view. Scouting by airships is, in any case, somewhat negative in character, since the fleet is only informed by them that the main hostile fleet is *not* within their field of vision, whereas the important thing is to know where it actually is.'<sup>4</sup>

<sup>1</sup> Vide *Germany's High Sea Fleet in the World War*, p. 182.

<sup>2</sup> August 19.

<sup>3</sup> August 20.

<sup>4</sup> *Germany's High Sea Fleet in the World War*, p. 185. This view is substantiated also in *The Zeppelins*, p. 132.

It is also of interest to remember that during these operations a kite-balloon was flown from a ship of the Grand Fleet—the *Hercules*—the flagship of Vice-Admiral Sir Doveton Sturdee.

On the third day of the next month (September) the enemy made an airship raid on this country, extending over a wide area. It is understood that the German naval staff had planned that this raid should be made with the greatest number of airships that could be mustered for the purpose. Altogether, 16 airships started (more than in any other raid during the War); of these, 12 were naval and 4 were military airships, and all except two (one naval—*L. 17*—and one military) crossed our coasts. The naval airships were *L. 11*, *L. 13*, *L. 14*, *L. 16*, *L. 17*, *L. 21*, *L. 22*, *L. 23*, *L. 24*, *L. 30*, *L. 32*, and the Schütte-Lanz airship *S.L. 38*. Only two of the military airships were identified—*S.L. 11* and *L.Z. 98*; one is known to have turned back when off the Long Sands light vessel. The tactics followed during this raid were similar to those of other raids. The majority of the airships crossed the Norfolk coast and then bore south-west towards London, while some of them made a counter-demonstration over the Humber. Only one reached London (and then merely its outskirts), and that was the Schütte-Lanz *S.L. 11*. This airship came from the sheds in Belgium and crossed the coast at Foulness Point (nearly mid-way between Clacton and Southend) at 10.40 p.m. Between Tottenham and Cuffley she dropped 12 bombs, and, when over the last-named place, was attacked by Lieutenant W. Leefe Robinson of No. 39 Squadron, R.F.C., in a B.E.2c, who succeeded in the attack. She came down in flames to earth at Cuffley. Inasmuch as this airship was largely of wooden construction, the wreckage burnt for some time and every man of her crew perished.

His Majesty the King conferred the Victoria Cross upon Lieutenant Robinson for the bravery he displayed during this action.

The destruction of *S.L. 11* was witnessed by the commanders of some of the other airships, and is known to have influenced them in their movements that night.

*L. 16* crossed the coast just north of Cromer at 10.40 p.m., but when over St. Albans, at about 1.45 a.m., her commander turned north, dropped some bombs at Essendon (mid-way between Hatfield and Cuffley), and then, after travelling over Cambridgeshire, Suffolk, and Norfolk, returned to sea just south of Great Yarmouth at 4.20 a.m. the next morning—September 3.

Shortly after 10.0 p.m. on the 2nd, *L. 32* crossed the coast near

Cromer and, at the time when *S.L. 11* was shot down, was at Tring (to the west of Luton). Thereafter her commander steered an easterly course to Ware, in the neighbourhood of which he dropped 4 bombs, then went out to sea, at 4.15 a.m., by way of Lowestoft.

Of the others, *L. 21* was at Flitwick when her commander saw the end of *S.L. 11*; he then turned about to the north-west, and went out to sea just after 4.0 a.m. near Hunstanton, after dropping several bombs north of Sandringham. *L. 14* crossed the coast near Wells-next-the-Sea, just before 10.0 p.m., half-circled King's Lynn, was just south of Peterborough at midnight and, at 2.25 a.m., her commander, when over Thaxted (south-west of Cambridge), saw the glare of the burning Schütte-Lanz airship in the sky. He then altered course to the north-west, dropped some bombs on Haughley, passed to the east of Norwich, recrossing the coast at Mundesley.

The naval Schütte-Lanz airship, *S.L. 8*, crossed the coast between Wells-next-the-Sea and Hunstanton, and had reached St. Ives (Huntingdon) when her commander also saw the tell-tale glare, and thereupon he turned to the north, passing out to sea just north of Wells-next-the-Sea.

*L. 30* crossed the coast south of Southwold at 10.40 p.m., dropped some bombs at Bungay, and, three-quarters of an hour later, came over Great Yarmouth and then went out to sea. *L. 24* likewise took but little part in the raid, coming in at Cromer, and a few minutes later went out to sea by Bacton. *L. 11* proceeded along the coast from Great Yarmouth to Harwich, dropping bombs on both places, and when over the last-named town she turned around and went out to sea to the north of Aldeburgh. *L. 23* spent most of her time over the Wash, although she dropped some bombs around Boston.

Of the airships that raided the north *L. 22* made her 'landfall' at Skegness at 10.10 p.m., proceeded up the coast of Lincolnshire, dropped some bombs on Humberstone (near Grimsby), reached Goole at 11.30 p.m., then headed south for a few minutes before turning to the eastward and going out to sea between Hornsea and Garton. *L. 13* made her 'landfall' at Spurn Head, dropped a few bombs at Owmyby and Gainsborough before reaching East Retford (mid-way between Sheffield and Lincoln) which she bombed, inflicting serious damage, which damage included the destruction of three gasometers.

There now remained the military airships. *L.Z. 98* crossed the

coast at midnight at Littlestone (between Folkestone and Hastings). The course she took brought her over Ashford, Maidstone, Sevenoaks, and Gravesend, upon which last place she dropped most of her bombs, the Dartford guns firing at her meanwhile. She then crossed the Thames, still heavily fired on, and steered north, passing to the westward of Chelmsford, then on to Ipswich, on the outskirts of which she dropped two bombs, finally going out to sea at Saxmundham, just after 2.30 a.m.

The other military airship made her 'landfall' at Frinton at about 11.0 p.m. Half an hour later, when over Mistley (a village south-east of Manningtree), an observation car was lowered from her.<sup>1</sup> For some unknown reason its supporting cable parted, and the car fell (with about 5,000 feet of cable) in a field near this village; the occupant was instantly killed. This airship then came over Haverhill (half-way between Great Chesterford and Ipswich) upon which she dropped 6 bombs, then turned north and went out to sea just north of Great Yarmouth at 1.45 a.m., dropping the winch for the observation car on the way.

As soon as the news of the arrival of these various airships reached Great Yarmouth air station, all the available pilots stood by to await instructions. At 9.45 p.m. Flight Lieutenant Kemball flew off from Covehithe in a B.E. 2c, and did not land for another hour and a half. On doing so, he reported that he had seen an airship caught in the beam of a searchlight, but she had managed to elude this beam, and he had then lost her in the thick clouds prevailing at the time. After this, at 10.25 p.m., Flight Lieutenant Cadbury left the air station in pursuit of one of the airships. He sighted one, held in the beam of a searchlight stationed at Lowestoft, but was unable to come within machine-gun range before she managed to evade the searchlight and escape into the clouds. Cadbury reported that, at the time, she was at an altitude of 6,000 feet, and, while most of the rounds fired at her from the anti-aircraft guns at Lowestoft fell short, two shots did, so far as he could see, 'burst right alongside her at a distance of 20 to 30 feet'. He landed at the air station just before midnight.

At midnight, Flight Sub-Lieutenant Pulling left Bacton in a B.E. 2c, and after a flight of 40 minutes he landed, having 'nothing to report'. Five minutes later he flew off again, and did not land till 2.10 a.m. (the 3rd), when he reported that he had seen bombs bursting to the south-east of the night landing-

<sup>1</sup> This car is now in the Imperial War Museum.

ground. Three-quarters of an hour later Pulling flew off again, and, after being an hour and twenty minutes in the air, landed at 4.15 a.m., having, this time, seen nothing of the enemy. This officer spent nearly three and a half hours in the air during this night; he had also flown several times on patrol during the day and evening.

In addition to the machines that were sent up by Great Yarmouth air station, many pilots from No. 39 Squadron, R.F.C., went up; also those from No. 50 Squadron, R.F.C., at Dover, and No. 33 Squadron, R.F.C., and also one Henri Farman ascended from the Isle of Grain. It is interesting to note that every machine that flew that night to attack the enemy was a B.E. 2c, with the exception of the Henri Farman from the Isle of Grain.

So ended the greatest raid by airships during the War; with all fairness to the enemy it should, it is felt, be classed as a failure. Sixteen tons of bombs (463 in number) it is known were dropped on land, and although unfortunately 4 persons were killed and 12 were injured, the material damage was small when the weight of bombs dropped is taken into account. The enemy lost an airship, and this admittedly had an effect on their Airship Service, for it now realized that the days were gone when airships could raid this country at the altitudes they had previously chosen. It was now evident that they must be able to escape our heavier-than-air craft, otherwise they were liable to be destroyed by a few rounds of incendiary ammunition.

The satisfactory results achieved during this raid by the defence also showed that the essence of a successful defence against aircraft (be it light or heavier than air) lies in the co-operation between the ground and air forces. It demonstrated particularly that pilots of defending aeroplanes could not achieve success unless their target were illuminated in the beams of a searchlight. It was the want of an adequate ground organization—guns, searchlights, and sound indicators—that handicapped pilots from Great Yarmouth and other coastal air stations in their anti-airship operations, for it is generally a pure accident if one aeroplane succeeds in shooting an airship or aeroplane down, during a raid by night, *if there be no searchlights and guns to aid.*

The destruction of the *S.L. 11* had a profound effect on the people of this country. For well over a year they had been subjected to many air raids, and by now were deeply indignant with the authorities for not apparently taking adequate steps to prevent

such attacks. Coupled with this feeling was that of anger with the enemy for waging war in a manner which, at the time, most Englishmen considered to be undesirable. True, airships had been destroyed before this one, but in no case had their end been witnessed, except by a few.

With *S.L. 11* it was different; her downfall was visible within an area of at least 50 miles radius, and must have been seen by many thousands of people and, to them, it seemed to be an end to the policy of 'darkness and composure', with which their rulers had counselled them to meet such visitations. From the technical side, it is interesting to note that, so far as is known, this was the first time that the enemy had employed an observation car hung from an airship when raiding this country.<sup>1</sup>

To return to the affairs of Great Yarmouth air station, on the 8th of this month (September) another officer—Flight Lieutenant Graham, D.S.O.—was killed. He had only recently joined from Dunkerque air station, and on that morning (the 8th) he had just left the water in a Short seaplane, but turned down wind before his machine had apparently attained full flying speed, with the result that his machine stalled and dived into the sea from about 200 feet. The bombs exploded and Graham was killed instantly, but his body was not recovered for another fortnight. Two or three days after this accident, a newly joined pilot spun his machine into the ground, smashing it completely; the pilot broke only his thumb.

September was to see two further attacks on Zeppelin airships by pilots from the air station. On the 23rd at 4.40 p.m. Flight Lieutenant Kilner left the station in a Short seaplane with Chief Petty Officer Rose, with orders to patrol the coast 40 miles to the eastward. Thirty-five minutes later Rose reported by wireless telegraphy that Kilner had attacked a Zeppelin airship at a position 45 miles east of Great Yarmouth, but that, unfortunately, she had escaped. Afterwards the seaplane and its crew were forced to alight at sea, and were adrift all night until they were picked up by a patrol boat and brought to the station at 9.45 a.m. the next morning.

One hour after Kilner had made his attack, Flight Lieutenant Galpin, in a Sopwith seaplane, attacked a Zeppelin airship 30 miles east of Lowestoft. Although he succeeded in firing one tray of explosive ammunition into her from his Lewis gun, the airship

<sup>1</sup> For a detailed account of the experimental work in connexion with this device, vide *The Zeppelins*, pp. 44-7.

did not catch fire, and Galpin was compelled to break off the action owing to darkness. It is not known whether these two officers attacked the same airship.

A few moments after these officers had ascended, Flight Lieutenant Cadbury went off to attack the raiders as they crossed the coast. He was in the air for two and a half hours, patrolling at a height of 7,000 feet; he saw nothing of the enemy and had to land in a ground fog for lack of petrol. Half an hour later a Zeppelin airship, in Cadbury's words, 'went over the spot where I had been patrolling, at the height I had been. I do have sickening luck.' He then 'turned in at 3.0 a.m.', but was aroused a little later and patrolled out at sea for an hour and a half in a seaplane at a height of 10,000 feet looking for enemy airships. On his return his goggles suddenly shifted across his eyes, momentarily blinding him, with the result that he dived into the sea at a speed of 120 knots. Despite his severe bruises and cuts he was flying again within a week, jocularly remarking that his size saved him, 'for instead of the machine breaking me—I broke the machine'.

Flight Lieutenant Galpin, flying in a Sopwith Schneider seaplane, attacked a Zeppelin airship 30 miles east of Lowestoft, and claimed that his bullets hit one of her gondolas.

On the night in question (September 23/24) 11 Zeppelin airships left their bases to raid this country. They were *L. 13*, *L. 14*, *L. 16*, *L. 17*, *L. 21*, *L. 22*, *L. 23*, *L. 24*, *L. 31*, *L. 32*, and *L. 33*. Of these *L. 16* turned back when half-way across the North Sea; another did likewise, but appears to have overcome her trouble (whatever it was) and later took part in the raid. This raid is of interest, in that it was the first one in which numbers of the new *L. 30* class were used. *L. 21* bombed Stowmarket; *L. 23*, however, crossed the coast and dropped her bombs in the sea off Cromer and Overstrand. *L. 31*, with Kapitänleutnant Mathy aboard, crossed the coast at Dungeness and came over to London by way of Tunbridge Wells and Kenley. Mathy then cut across London from south to north, bombing Mitcham, Streatham, Brixton, and Kennington. He then crossed the Thames, and when over Lea Bridge, dropped some more bombs which inflicted severe casualties—22 killed and 75 injured. He left this country just before 1.0 a.m., crossing the coast by Great Yarmouth.

*L. 32* (Kapitänleutnant Petersen) also crossed the coast at Dungeness, later passing over the Thames at Dartford, and a short while after was shot down in flames by Second Lieutenant F. Sowrey, R.F.C., of No. 39 Squadron. The remains of this

airship fell in a field near to Snail's Hall Farm, Great Burstead, south of Billericay. All on board her perished, and the only damage the burning airship did when it crashed to ground was to singe the hair of a fox terrier dog belonging to the farm.

It is related that when a cordon of troops had been thrown around the remains of this airship, a newspaper reporter approached an officer of the Royal Flying Corps with the request that he should be told the name of the officer who had shot her down. The answer he received was, 'The Royal Flying Corps, Sir'. He persisted, and received the same answer, with greater but polite emphasis. It is said that the reporter went away, but did not understand what was implied in the remark.

A few minutes later another airship suffered a similar fate, for *L. 33* (Kapitänleutnant Böcker), after having bombed the East End of London (inflicting many casualties and heavy damage), was attacked by anti-aircraft guns and by an officer of the Royal Flying Corps, Second Lieutenant A. de B. Brandon, also of No. 39 Squadron.<sup>1</sup> This airship, although not set on fire, was badly riddled and was forced to the ground in a field between Little Wigborough and Peldon. She caught fire as soon as she hit the ground, but owing to the loss of gas was not badly burnt. Kapitänleutnant Böcker and his crew escaped injury, and later were found by an astonished and resourceful Special Constable who 'took them in charge'.

Although 5 airships raided the northern districts, only one did much damage, and that was *L. 17* which bombed Nottingham. Altogether a total of 368 bombs was dropped during this raid, as a result of which 40 persons were killed and 120 injured; most of the damage was done in London and Nottingham. During this night, in addition to those mentioned from Great Yarmouth, pilots also went up from the naval air stations at Cranwell and Eastchurch and from certain Royal Flying Corps Squadrons—No. 50 at Dover, No. 51 at Thetford, and No. 33 at Beverley.

The enemy lost two modern airships. *L. 32* had been commissioned on August 8, and had made only 13 flights before her destruction, including three raids and four 'war flights'. Her observation officer was Oberleutnant Brodrück. *L. 33* had even a shorter life—22 days—as she was commissioned on September 2 and was destroyed on her first raid. Her observation officer was Oberleutnant Schirpitz.

<sup>1</sup> This officer, it may be remembered, had attacked *L. 15* the night she was brought down—March 31, 1916.

To conclude the account of the affairs of Great Yarmouth air station during September, the following officers joined the station: Flight Sub-Lieutenants R. Leckie, N. W. Leslie, T. G. C. Wood, and L. E. R. Murray.

The night of October 1 witnessed another airship raid, this time by 11 airships—*L. 13*, *L. 14*, *L. 16*, *L. 17*, *L. 21*, *L. 22*, *L. 23*, *L. 24*, *L. 30*, *L. 31*, and *L. 34*. Four of them did not cross our coasts, namely, *L. 13*, *L. 22*, *L. 23*, and *L. 30*, but the others came inwards. *L. 14*, *L. 16*, and *L. 21* raided Lincolnshire, but the bombs they dropped inflicted no damage. *L. 24* crossed the Norfolk coast and reached Hitchin and bombed the night landing-ground at Willians, killing one man. *L. 34*, which was on her maiden trip, flew over the East Midlands, but the bombs she dropped did little damage. *L. 17* dropped bombs in the neighbourhood of Norwich, but likewise did no damage. Kapitänleutnant Mathy, in *L. 31*, crossed the coast at Lowestoft at about 8 p.m. and reached Chelmsford. At 8.30 p.m. Flight Sub-Lieutenant Northrop flew off in a B.E. 2c from Burgh Castle and patrolled the neighbourhood for 40 minutes but did not see *L. 31* on account of the mist, and so landed. Mist and fog prevented any other machines from Great Yarmouth air station from leaving the aerodrome. This airship (*L. 31*), however, did not escape destruction, for, after having crossed over Hertfordshire (bombing Cheshunt) and Essex and being located by searchlights and subjected to anti-aircraft gun-fire, she was attacked by Second Lieutenant W. J. Tempest, R.F.C., and shot down in flames. The whole of the crew perished, the remains falling in a field at Potter's Bar.

This loss was a severe one to the enemy Airship Service, not so much because of the loss of the airship, but of Kapitänleutnant Mathy—probably the most able and experienced of German airship pilots.

Heinrich Mathy was born in Mannheim in 1883, and was the son of a well-known old family in Baden. In 1900 he entered the Imperial German Navy, and 13 years later was trained as one of the first naval airship pilots, serving aboard *L. 1* and *L. 2*. On the outbreak of war he was in command of a torpedo boat, but in January 1915 he returned to the naval airship Service as the commander of *L. 9*. In August of the same year he was posted to *L. 13*. His hundredth airship flight was made on the occasion of his first attack on London (September 8, 1915).

He made many raids on this country, besides a large number of

lengthy reconnaissance flights over the North Sea. Strasser referred to him as 'an officer of never-failing energy, without consideration for his own person, always sportsmanlike, a true comrade, highly thought of by his superiors and by the men'. Graf von Zeppelin 'called him his friend and prized him as one who had the same aspirations as himself'. Speaking of him, his widow (who has been good enough to contribute the foregoing biographical notes) has remarked that 'he fell in the prime of his life, sacrificing it with joy for his country'.

*L. 31* had only been in commission three months (July 17), and had always been commanded by Kapitänleutnant Mathy. Her first observation officer was Oberleutnant Freimel, but, at the time of her fall, was Oberleutnant Werner. Before her destruction she had made 6 raids and 4 war cruises.

From the point of view of material damage this raid (September 23/24) was a failure. A total of 201 bombs was dropped, and although unfortunately killing one person and injuring another, the damage to property was very small. In accordance with its practice the German Press grossly exaggerated the damage inflicted. Statements were made that:

'Twenty houses in Maple Street were damaged. At Thamesshaven benzol tanks were greatly damaged and rice storehouses destroyed. At Grimsby, barracks were hit, and over 400 soldiers killed. On the Humber a big cruiser was hit. At Leeds, great havoc was done among the ammunition factories, railways stations, &c. . . . a four funnelled cruiser and two or more warships were damaged, and that 60 men were killed on board the four funnelled cruiser in the Humber.'

All of which was incorrect, but throughout the War the German people 'held exaggerated ideas concerning the destructive powers of the Zeppelins'.<sup>1</sup>

During October the German fleet was active in the North Sea, for, after the attempted raid on Sunderland of August 18/19, Admiral Scheer has told us 'a similar enterprise was planned for September', but the operation fell through on account of bad weather. This projected attack differed from its predecessor in that, 'lacking U-boats', he 'was forced to adopt a different scheme; instead of making for the English coast and luring the enemy on to our line of U-boats before the actual battle took place, I had to make a widespread advance with torpedo boats to take stock of the commercial traffic in the North Sea and capture

<sup>1</sup> *The Zeppelins*, p. 88.



prizes. The fleet was to serve as a support to the light craft that were sent out.'<sup>1</sup>

Scheer tells us that on the 19th the fleet advanced 'according to . . . plan to the centre of the North Sea, but owing to bad weather the torpedo boats were unable to go far afield' and the raid was abandoned. Despite the 'awful weather' that night, Great Yarmouth air station 'managed to send out patrols, but they saw nothing'. Those at the station were told that 'the German fleet was out again, accompanied by 9 Zeppelins, 4 of which were within 40 miles of us'.

After the enemy sortie of the 19th two torpedo-boat flotillas—III and IV<sup>2</sup>—were sent on the 23rd 'to Flanders', which they reached safely the next day. This transfer was known to the British Admiralty, and, in addition to fleet movements, the personnel of the air station was told to attack any enemy forces that might appear off their patrol areas. The part that certain officers of the station played that night, and the next morning, is best described by quoting from a letter of Flight Lieutenant Cadbury's:

'Monday evening we had a phase of activity. I was sleeping down at the sheds that night and about midnight got a signal to say that the German Fleet was out and to prepare for bombardment at dawn. All night we were running and testing engines and just before dawn two wireless patrols got away. About half an hour after the last one left, it wirelesslyed back that 6 German battle cruisers were entering the Roads from the north. We all expected to be blown flat every second. I went off in a 225 h.p. Short with 4 or 5 cwt. of bombs, and I may say I was very thoughtful. The clouds were about 1,500 feet, so I should have had to have gone over them at very low altitude, and consequently been a sitting target for them. I searched up and down the Roads for about an hour and a half, but could not find them. I thought I had missed them, so I chased out to sea. I careered about 50 miles out along the channels, but could not see them, so returned.'

'On landing I learnt that the 6 German cruisers were 6 of our paddle mine-sweepers which, in the dim, foggy, half-light of dawn, had been mistaken for Germans, who in reality did not come in this direction. However, that was not all—on the strength of this report two machines carrying torpedoes had been sent out; one failed to return. As an awful sea got up about noon we knew he must be done in unless he was picked up; as we heard nothing for four days, and as terrific seas had been running, we concluded that he was drowned. On Friday night we got a signal from Holland to say that he had been picked up by one of the Dutch luggers, and was safe, but that his machine was lost.'

<sup>1</sup> *Germany's High Sea Fleet in the World War*, pp. 186–7.

<sup>2</sup> These flotillas raided the Straits of Dover seven nights later.

To conclude the account of the activities of the station during this month, Flight Lieutenant Galpin, with Air Mechanic Haines, made, on the 24th, one of the longest patrols of the War in a float seaplane—flying, in bad weather, from the air station to the Texel. On his return journey Galpin went as far south as Foulness Point. Later he alighted at Felixstowe air station to replenish the petrol tanks of his machine; when he returned to Great Yarmouth he had been flying for over 7 hours. Nothing of the enemy's naval forces was seen.

One of the duties of the pilots of the Royal Naval Air Service, when on patrol, was to keep a look-out for any floating mines and, if they sighted them, to endeavour to explode or sink them with machine-gun fire, or, failing this, to inform surface craft of their presence and position. During this month (October) Flight Sub-Lieutenant Bittles, while flying in a Short seaplane, saw a floating mine near the Cross Sands light vessel and tried to sink it, but failed. As there were some armed trawlers in the neighbourhood, he circled about them, firing Véry lights to attract their attention. These vessels, together with a mine-sweeper, thereupon swept the area and sank six mines.

During the first few days of November experiments were made at the air station with firing *Le Prieur* rockets into free balloons, in order that pilots could gain experience in handling this weapon.<sup>1</sup> At the same time three Horace Farman machines were sent to the station. This machine (of French origin) was a 'pusher' biplane, combining the characteristics of the 'Henri' and 'Maurice' types, and was equipped with the 135 b.h.p. Renault engine.

The end of this month was to see yet another airship raid and the loss of a Zeppelin airship—the first to be destroyed by pilots from Great Yarmouth air station. On the afternoon of the 27th 10 naval airships left their sheds to make this raid. They were *L. 13*, *L. 14*, *L. 16*, *L. 21*, *L. 22*, *L. 24*, *L. 30*, *L. 34*, *L. 35*, and *L. 36*, it being the maiden raid of the last two airships. Of all these, seven crossed our coast. The latest airships of the *L. 30* class, namely, *L. 34*, *L. 35*, and *L. 36*, together with *L. 24*, steered a course for the Tyne, while *L. 13*, *L. 14*, *L. 16*, *L. 21*, and *L. 22* made the Midlands their objective. Those airships that made for the Tyneside were soon to suffer loss, for *L. 34*, after crossing the coast at Black Hall Rocks, was attacked

<sup>1</sup> These rockets were the invention of a French naval officer (of that name). They were affixed to the interplane struts of the machine and were fired electrically.

by Second Lieutenant I. V. Pyott, of No. 36 Squadron, R.F.C., and shot down in flames, the burning mass falling in the sea off West Hartlepool. Her commander, Kapitänleutnant Max Dietrich, together with Oberleutnant von Nathasius, and all her crew, perished. An air of pathos touches the death of the first of these officers of this airship, in that this day was also his birthday. This loss of a brand-new airship (she was commissioned exactly two months before) was a severe blow to the enemy, for it was one of the new *L. 30* class, which superseded the *L. 20*'s. This new type had a capacity which was greater by 19,400 cubic metres (68,500 cubic feet) than the latter. They had 14.6 tons more net lift, and were faster. Owing to the improvement in our defences much attention had been paid to 'ceiling', and an airship of this class had a static ceiling of 5,400 metres (17,700 feet), which was 1,200 metres (3,950 feet) more than airships of the *L. 20* type were capable of reaching.

To return to the raid, so great was the glare from the burning *L. 34* that it was seen in the air by another pilot of the Royal Flying Corps who was 140 miles away. Her destruction would seem to have had an effect on her consorts, for *L. 35*, which crossed the coast with her, put about and left our shores without dropping a single bomb, as also did *L. 36*; *L. 24*, which was not yet over the coast, did likewise.

*L. 21* crossed the coast at Atwick soon after 9.0 p.m. and was engaged promptly by the guns at Barmston, and so went out to sea, but crossed the coast again farther north, and was over Great Driffield (south-west of Flamborough Head) at 9.45 p.m. Thence she passed on to Wakefield, in the neighbourhood of which she dropped her first bombs. At midnight she was over Barnsley and dropped some more bombs—this town and Wakefield had been bombed a few hours earlier by *L. 16*. At 1.0 a.m. (November 28) *L. 21* was over Macclesfield, whence she proceeded westward to Hanley and dropped some bombs on some slag heaps at Chesterton. She then turned about and passed over, or near, Stoke-upon-Trent, Uttoxeter, Melbourne, Long Eaton, Melton Mowbray, and then, following a winding course, went out to sea between Great Yarmouth and Lowestoft and was destroyed—just after her commander had sent a wireless telegraphic message to her base that his command was returning home—after having been over this country for about 9 hours.

The manner of her destruction may be described now. The news of her impending approach had been reported at 5.7 a.m.

(the 28th) to the commodore at Lowestoft (Commodore Ellison), who gave orders for two machines, one from Bacton and one from Holt, to attack *L. 21* at once. All pilots at Great Yarmouth air station and the night landing-grounds had been 'standing by' from 7.0 p.m. the previous evening. The report to the commodore stated that a Zeppelin airship had been sighted over Swaffham at 4.40 a.m. and over Dereham 23 minutes later. So at 4.55 a.m. Flight Sub-Lieutenant Pulling left Bacton in a B.E. 2c (No. 8626) with orders to patrol for one hour. This officer was followed 8 minutes later by Flight Lieutenant Cadbury, who left Great Yarmouth, also in a B.E. 2c (No. 8265), but 12 minutes later he landed at Burgh Castle because he was experiencing trouble with the sparking-plugs of his engine. There he met Flight Sub-Lieutenant Fane who, at 11.0 p.m. the previous evening, had been flying for over an hour and a half looking for one of the airships that had been reported near Cromer; he had, however, not sighted her, so returned to the night landing-ground.

He has described subsequently his activities of this evening, saying:

'I had just had my B.E. 2c armed with a Lewis gun and had had the very latest explosive and tracer bullets loaded in the trays when we got the warning to stand by for immediate action. This was at about 7.0 p.m., November 22. Flight Lieutenant Cadbury and myself being the only two night pilots at the station that night (the others being at Bacton, Holt, and Covehithe), got our machine ready and warmed up. As the wind was not very favourable for the aerodrome, which was very narrow, I asked to go to Burgh Castle aerodrome, which was much better. I only landed there about 9 p.m. and filled up with petrol and oil and generally made sure that everything was in good order. I went up about 11.0 p.m. to patrol as an airship was reported near Cromer, steering south-west in the direction of Norwich. After flying for about an hour and a half and getting up to 10,000 feet, I saw nothing at all, so I returned to Burgh Castle. I reported by telephone to Yarmouth and refuelled.

'About 4.0 a.m. hostile aircraft were reported over Newmarket, flying east, and so I mustered the few hands on the station and endeavoured to start up my engine. The weather was intensely cold, and as my machine had been left in the open, starting was no easy matter. However, with the aid of hot bricks laid on the induction pipe we managed to get the engine running. While it was warming up Cadbury came down with plug trouble and he gave me the latest reports while his sparking plugs were being changed. It appeared that the airship was approaching Bungay, steering east about 30 miles away. I left the ground about 4.35 a.m., and steering towards Lowestoft I climbed as high as was possible. On attaining a height of 6,500

feet I started a patrol up and down between Yarmouth and Lowestoft as I had calculated that the airship must cross the coast between these points, as she was getting short of darkness and could not afford time to dodge about.'

Cadbury, after correcting the trouble with the sparking-plugs in his engine, left Burgh Castle at 6.18 a.m. and carried on with his patrol. A few minutes later he saw *L. 21* making out to sea and thereupon gave chase. Meanwhile Pulling (who, it may be remembered, had left Bacton just before 5.0 a.m.) had been patrolling for the first 40 minutes at a height of 9,000 feet and, in his own words, 'nothing unusual had been seen during this part of the patrol'. At 6.0 a.m., as he had been told to patrol for only an hour, he started to descend. When he was at a height of 6,000 feet he saw anti-aircraft guns in action in the direction of Great Yarmouth, so 'immediately steered a course south-east, hoping to intercept the target out to sea'. At 6.5 a.m. Great Yarmouth reported 'a Zeppelin airship overhead'. Ten minutes later Pulling saw *L. 21* and immediately started in pursuit, having by this time climbed to 8,000 feet. A few minutes later he saw 'an attack being made on her by a machine' which he was unable to see; the tracer 'ammunition was clearly visible'. This machine was that flown by Cadbury who, in company with Fane, had overtaken *L. 21* approximately 9 miles east-south-east of Lowestoft naval base. Cadbury, in the words of Commodore Ellison, 'got under her about 700 feet distance and fired his Lewis gun into the after part of her under heavy fire from the Zeppelin'. This first tray had no effect, so he put on another one and fired this into her, still with apparently no result. Two more trays were fired into her and nothing happened, and by this time Cadbury had expended all his ammunition. It should be said that he had been under heavy enemy machine-gun fire during all this time. As soon as Cadbury attacked *L. 21* she increased her speed from 30 to 50 knots.

Shortly before Cadbury's ammunition was expended Fane flew to the attack, and, in his own words:

'I soon sighted her about 2,000 feet higher than I was, going out to sea over Corton, and started in pursuit. After a short time I had got to her level about a mile or so away and finally I got myself into a position just under her tail and within 30 feet of it and started firing at her. I only got off one round, however, when the gun jammed and so I soon cleared out of the position I was in owing to the fact that I was right in the slipstream of her 5 engines which made the machine very difficult to control, and also there

was another machine some way below me firing like mad and evidently could not see me; this turned out to be Cadbury. I then endeavoured to clear the jamb in the gun, but I was not able to do it in the excitement of the moment, so I set about getting above the Zeppelin to bomb it. Having got to about 500 feet higher than the airship, I turned to cross over and drop all my bombs on her.'

While this officer was underneath the airship Fane saw two of the crew in the port and starboard gondolas endeavouring to train a machine-gun on to him; but the stops of the gun-mounting prevented them from traversing their guns sufficiently far to bring the sights on to him or on to his machine. It is not without interest to note that Fane was still in his 'teens at this time.

Directly after Cadbury had ceased firing, Pulling, in his own words:

'came level with the Zeppelin at 8,000 feet approaching her at right angles on her port quarter, turned sharply to the left and passed about 50 feet beneath her, firing as I did so. The Lewis gun fired two shots, both hitting and stopped, and she immediately opened fire with a machine gun, apparently from the gondola. I turned sharply to the right, intending to keep out of range until I had cleared the jamb. A few seconds later, on looking over my shoulder, I saw the Zeppelin was on fire by the stern.'

There is no doubt that the rounds fired by Cadbury had taken effect, for he was the only one of the three officers who attacked *L. 21* from the stern, and she caught fire at this place.

Returning to the account of Fane's attack, as he 'turned to cross over' and drop all his bombs on her he 'saw she was on fire at the stern. At the same moment, the gunner who was in the cockpit on the top of the airship saw the flames, stopped firing at me, whether or not he had a parachute I don't know, but he ran straight over the nose of the ship just before she exploded and disappeared.' Fane's face and flying helmet were scorched badly and parts of his machine were blistered by the flames.

After Pulling saw that she was on fire by the stern 'he was to the south-east of the Zeppelin, and apparently a good target against the dawn, for the fire was kept up for several seconds after she was alight. . . . The flames spread with great rapidity . . . and within a few seconds was nothing but a fiery furnace.' One of the crew of the airship continued to fire his machine-gun until he was enveloped in flames, thereby setting a fine example of devotion to duty.

The remains of *L. 21* fell into the sea about 10 miles to the eastward of Lowestoft, where, in the words of Commodore Elli-

son (who witnessed the action from Lowestoft Pier), 'she engulfed and entirely sank, leaving a large area of oil-covered water'. Nothing was ever found of her except a broken propeller blade. The commodore also estimated from 'personal observation' that 'it took about a minute from the time of her ignition to the time she struck the water'.

So died Kapitänleutnant Frankenberg and all his crew in an airship that was commissioned 10 months earlier (January 10), and that had made 11 raids on this country. The whole attack was witnessed from the air by Flight Commander Nicholl, who had left the air station in a B.E. 2c at 7.20 p.m., but who was too late to participate in the action.

In recognition of their services during this attack His Majesty the King appointed Flight Sub-Lieutenant E. L. Pulling a Companion of the Most Honourable Distinguished Service Order and conferred the Distinguished Service Cross upon Flight Lieutenant Egbert Cadbury and Flight Sub-Lieutenant G. W. R. Fane.

*L. 22*—the sister ship of *L. 21*—nearly suffered the same fate as her consort, for she was hit by shell-fire when over Yorkshire, and only just managed to reach Germany. Her observation officer was Oberleutnant Richard Frey, and in an account of the events of that night which he subsequently wrote he, after describing the loss of *L. 34*, said:

'But we ourselves had suffered all round. When I came down again from the platform, the lighting plant failed in the airship. All our telegraphs, compass, and altitude barometer were without light and our crew had to resort to pocket lamps. The greatest inconvenience was caused by the want of light in the wireless room, where there was plenty to do for me now. In the first place, we had to wireless our report on the raid to Strasser, so that the commander of the fleet and our leader should know where we had raided, and that we were on our way back. Unfortunately, it was soon found that our ship was steadily increasing in weight. Owing to the two hits by shrapnel, 10 of our cells had been punctured, and the gas was leaking from them steadily. Our sail-maker, Wundrack, stepped into the breach like a hero. He crept up to the top of the ship in order to stop the holes, as it was, of course, through the holes on top that most of the gas was escaping. It goes without saying that our position could not be much improved by this, as we had innumerable shrapnel holes in the cells. Later, when we had returned to the shed, it was found that there were about 150 holes in the ship. Our ship was becoming more and more heavy and could hardly be steered. We therefore threw overboard two more petrol tanks which we could spare, but we very soon again took a bad list. Meanwhile, I was trying in the wireless room, with the wireless operators, to decipher the messages

received, with the aid of pocket-lamp and the signal book. In this manner, we also received the report of the raids by the other ships, which had set out together with us, with the exception of *L. 27*. This ship was also repeatedly called by the flagship of the Fleet, but unfortunately without any success. It was to be feared that she had also become the victim of the enemy's defence, and on returning to port we heard to our regret that this opinion was confirmed. Frankenberg and Salzbrunn had died like heroes with their brave crew.

'Meanwhile, our position had become critical. To make matters worse another engine packed up, and this increased the stern list of the ship. If this was to go on, we could no longer hold up in the air and must sink into the North Sea, where we should probably meet the same fate as *L. 19* previously did. We must do everything possible to get assistance from naval craft, who could pick us up. I therefore signalled to the commander of the Fleet, telling him our position, and asking him to send out ships to stand-by, as we were seriously damaged.

'As the list was becoming even more serious, we attempted to trim the ship and dragged along the gangway everything heavy that could be spared from aft to right forward. In the darkened gangway and owing to the heavy list this was extraordinarily hard work. In order to understand it, I may mention that the gangway is a narrow board, only 8 inches wide, made of stretchers. Stepping aside meant at once crashing through the envelope into the depths below. Therefore, it was not quite a simple matter to move along this gangway in the dark and carrying loads.

'We had given the engineers a definite time in which to repair the engine, otherwise, they were to dismantle it and throw it overboard. By good luck they succeeded in repairing it, and then we had all the tools and all the machine spare parts thrown overboard, so that our position was, to some extent, once more improved.

'At last the sun rose—a rosy light in the east, and this gave us fresh hopes and a new courage. After a little time we could distinguish the East Frisian Islands, and then also sighted the great cruiser *Möltke*, with two smaller cruisers and a torpedo-boat flotilla, steaming towards us, with the intention of picking us up.

'With the rising of the sun our gas had become warmer and our lifting capacity had thereby increased. We therefore felt quite proud of ourselves and we wirelessed to the Fleet: "Endeavouring to land in Hage on our own power." Under no circumstances could we reach our home station, but we still had hopes of reaching Hage. At 8.0 a.m. we stood over the place. The question now was to lighten the ship as much as possible, and consequently threw overboard all empty water sacks, fur coats, fur-lined boots and the like, and then our last two petrol tanks, which crashed on the ground with a loud report. At 8.30 a.m. we could then proceed with the landing, and we let the ship fall on the ground with a weight of about 6,600 lb. As we expected a heavy impact, we all stood gently kneeling in the steering car, while we sent all the crew that could be spared into the gangway, so

that no one should be hurt unnecessarily. The landing squad behaved so well, however, that they caught the forward car quite gently. With regard to the aft car, the ship landed on a post standing 6 feet high and rammed it completely into the earth. Anyway, this damped the impact quite well, so that the operation went through somewhat gently. The shafts of the side propellers were bent and some rings were broken in the frame, in addition to this some of the supports of the side propeller gearing were broken. None of the crew was hurt. We had thus brought the ship safely into port and we rode into the shed to the sound of the music played by the station band.<sup>1</sup>

The weather in December was so bad at Great Yarmouth that for most of the time flying was almost impossible, and so the greater part of the time was spent at the air station in improving the ground organization. At the end of the month there were 31 machines on the station—1 Avro, 6 B.E. 2c's, 3 Bristol Scouts, 2 Sopwith Scouts, 1 Horace Farman land machine, 12 Short, and 6 Sopwith seaplanes—but not all the machines were 'fit for service'.

Squadron Commander D. A. Oliver, D.S.O., had at the end of this month 41 officers (including two warrant officers) under his command, of which 29 were pilots. The following officers joined the station between August and December: Flight Lieutenant G. E. Livock and Flight Sub-Lieutenants H. B. Brenton, E. J. Crisp, S. J. Fetherston, A. M. FitzRandolph, G. R. Halliday, C. S. Iron, R. Leckie, N. W. Leslie, L. E. R. Murray, G. H. Simpson, F. P. L. Washington, F. W. Walker, H. Wild, and T. G. C. Wood. Some of these officers did not remain on the station for long, being posted to other units.

The work of the year at the station may be summarized by saying that a considerable amount of flying (especially at night) was done with inadequate material. Pilots at the station took part in many anti-airship operations, but on no occasion did any of them see, when on patrol, an enemy heavier-than-air machine.

Although by the end of the year it was evident that the development of anti-hostile submarine measures had not kept pace with the increasing intensity of the attack by these vessels on our commerce, aircraft played but little part in meeting this menace. In fact, until the late spring of 1917 anti-submarine operations conducted by aircraft were spasmodic, inco-ordinated, and ineffective. Seaplane pilots at Great Yarmouth air station, even at the end of 1916, frequently went out on patrol armed only with

<sup>1</sup> *Deutsche Zeitung*, May 20, 1927.

two 25-lb. bombs, a Véry pistol, a few cartridges, and with no wireless telegraphic apparatus.

What success in its varied duties the station did achieve was largely due to the inspiring example set by the commanding officer and his able and gallant first lieutenant (Flight Commander V. Nicholl, D.S.C.).

Of Squadron Commander Oliver it was said:

'We always looked on him as a very shrewd judge of the military situation. He did keep up a spirit of enthusiasm and initiative all the time. I remember his evolving two slogans—"Out they go—the brave boys", and "One good laugh a day". We certainly kept up to both, and it is due to him to say that he kept us at a pitch of excitement which loosened us up for whatever job had to be done. The unexpected is to be expected in war: and he certainly made a study of the unexpected in his daily life.'

The chief petty officers, petty officers, and men must not be forgotten, for the lower-deck ratings in the Royal Naval Air Service were of a high standard. One of the most experienced pilots on the air station has since said that:

'I think a word ought to be said for the observer ratings who accompanied us on patrols. They were of all ages—from Chief Petty Officer Heywood, who was a naval rating of many years service (and is now (1928) a Flying Officer in the Royal Air Force), down to the youngest apprentice signaller who came to us out of the training schools. It was their duty to accompany as passenger any pilot on patrol; which, in view of the very mixed batch of pilots which we had, was a serious undertaking indeed. Nearly all of them got "ditched" at one time or another. It must be remembered that the passenger had no control over the machine if his pilot failed, and that whereas one might feel reasonably safe behind the senior pilots of the station, there were some younger ones whom it could have been no pleasure at all to accompany.'

'Yarmouth air station—chiefly owing to the activities of Chief Petty Officer Heywood—acquired a reputation among the Royal Naval Air Service wireless authorities of being able to produce results from any kind of apparatus, however ancient. We retained the Rouzet sets long after other stations had proved themselves incapable of working them, and I am under the impression that we held the record for long distance with one of these sets.'

While particular mention has been made of the 'wireless ratings' this high standard was shared by all the chief petty officers, petty officers, and men on the station.

### XIII

## THE 'AIR AGITATION' AND THE GENERAL DEVELOPMENT OF THE ROYAL NAVAL AIR SERVICE DURING THE YEAR 1916

IT was once said that the Achilles heel of an air service is the supply and maintenance of its aircraft, and the experiences of the year 1916 amply confirmed the truth of this statement.

Towards the end of 1915 public opinion was becoming in favour of some form of co-ordination between the two flying Services, and this feeling grew in intensity during 1916, largely because of the 'Fokker scourge' and the airship raids.

Despite the statements of official apologists it was generally known that the pilots of the Royal Flying Corps were ill equipped with efficient fighting machines, as compared with the Germans, and, in consequence, the casualties of the Corps were heavy.

Although the airship raids had achieved, admittedly, some moral effect, it was found that this depended not so much on the material damage inflicted but rather upon the success, or ill success, of our defensive measures. In the early part of 1916 the majority of people in this country felt that not only were these measures totally inadequate, but that the authorities were not alive to the menace that these raids presented.

Added to this feeling of disquietude was the knowledge that in all matters of administration the break between the two flying Services was complete. Those with any knowledge of the subject viewed with alarm a condition of affairs which allowed two Services, in time of war, to compete vigorously in the same market for the same article. The official view might be that the conditions allowed of a 'generous rivalry',<sup>1</sup> but the general opinion was that it was nothing more or less than 'a deplorable and extensive competition'.<sup>2</sup>

Arising out of this dissatisfaction the feeling grew, not only outside but within the Services, that the country's Air Services must be reformed. The proposals which were put forward to meet the difficulty were many, but they may be divided broadly under four headings: firstly, to improve the machinery of co-

<sup>1</sup> Mr. A. J. Balfour's speech in the House of Commons, November 11, 1915.

<sup>2</sup> *The Times*, February 8, 1916.

ordination between the two existing Services; secondly, to amalgamate the production of aeronautical material—the Services otherwise to retain their own entity; thirdly, to amalgamate not only the production of material but the training of personnel; and, fourthly, the establishment of an Air Ministry and a unified Air Force which would not be ancillary to the Navy and Army.

These various proposals were expounded with considerable vigour and warmth in both Houses of Parliament and in the press. Eventually, on February 24 (1916) the Government of the day, in the hope of finding a solution of their difficulties, appointed a new Air Committee, under the chairmanship of Lord Derby. The old Air Committee, although never abolished, was dormant, and in fact had held no meetings since the beginning of the War. The members of the resuscitated Committee were Lord Derby, Lord Montagu, Rear-Admiral C. L. Vaughan-Lee, Captain Murray Sueter, Commander E. F. Briggs, D.S.O., Lieutenant-General Sir David Henderson, K.C.B., D.S.O., and Colonel E. L. Ellington, C.M.G. Sir Maurice Hankey and Lieutenant-Colonel L. Storr of the Committee of Imperial Defence acted as secretaries. The object of this Committee 'was to prevent competition between the Services and to increase the output of machines by co-ordination of design and the placing of orders'.<sup>1</sup> It had no executive powers and failed for lack of them, and both Lord Derby and Lord Montagu tendered their resignations on April 12, and thereafter the Committee ceased to exist. Lord Montagu remarked afterwards, in a public speech, that 'the Committee had no real executive power, and I felt, and Lord Derby felt, that it was perhaps lulling the public into a sense of false security, and I, for one, determined not to be made use of for such a purpose.... Is it possible', he asked, 'to go on running the air defence of the country by two, and sometimes three, departments, without any link, but with traditional jealousies existing between them?'

The result of the failure of this Committee fanned the flames of popular indignation. In March Mr. Pemberton-Billing<sup>2</sup> made several speeches in the House of Commons in which he vigor-

<sup>1</sup> The War Cabinet—Report for the Year 1917, p. 57.

<sup>2</sup> This gentleman had retired from the Royal Naval Air Service with the rank of Squadron Commander to fight, with the Admiralty's permission, the Mile End election as an Independent member, purely on the question of an adequate Air Service. He was defeated, but was elected the Member for East Herts., on March 10. While in the Service he had been responsible for some of the staff work in connexion with the raid on Friedrichshafen, November 21, 1914.

ously criticized the administration of the Air Services, and in one (March 21) said that pilots of the Royal Flying Corps operating in France had been 'rather murdered than killed'. He attacked the aeroplanes designed by the Royal Aircraft Factory, and in particular the B.E. 2c, which was hopelessly outclassed by the contemporary German fighting machines. The Under-Secretary of State for War (Mr. Tennant), in reply, denied the inferiority of British machines, but, seven days later, while defending the general system, promised a Judicial Committee to investigate Mr. Pemberton-Billing's 'murder charges'.

All through April the agitation grew in intensity, and many attacks were made on the administration of the Royal Aircraft Factory and the policy which prevented, in general, the Royal Flying Corps being equipped with any other machines than those designed by the staff of the Factory. Critics pointed out with justification that the Royal Naval Air Service was infinitely better equipped with machines (which were built by the 'trade'), and insisted that pilots of the Royal Flying Corps had every right to machines of the same performance, especially as they had to do infinitely more fighting than their sister Service.

It must not be thought that those outside the Service were the only people who were aware of the grave state of affairs, but those in the Service naturally could not lend themselves to any form of popular agitation. They had to work towards their goal strictly in accordance with the laws of the Service.

On May 10 the composition of the promised Judicial Committee to inquire into the 'murder charges' was announced. The Chairman was a Judge of the High Court, Sir Clement Bailhache. The other members were Mr. J. G. Butcher, K.C., M.P., Mr. Edward Shortt, K.C., M.P., Mr. J. H. Balfour Browne, K.C., Sir Charles Parsons, General Sir Horace Smith-Dorrien, and Mr. Charles Bright. Mr. Cotes-Preedy was the secretary. The Committee began sitting on May 18, and sat at intervals until July. It issued an interim report on the so-called 'murder charges' in September and its final report in December. In general, owing to the wildness with which accusations of mal-administration had been made, the report exonerated the Department of Military Aeronautics, but the agitators got what they wanted also.

The interim report<sup>1</sup> dealt 'only with the charge of original

<sup>1</sup> Interim Report of the Committee on the Administration and Command of the Royal Flying Corps, &c. (Cd. 8192).

negligence made by Mr. Pemberton-Billing against the administration and higher command' and, in general, found the charges not proven, and the report commented somewhat strongly on the manner of their making, saying that 'No one could complain if Mr. Pemberton Billing had asked that these cases should be inquired into to ascertain whether the deaths of the men might have been prevented, but to base upon these accidents charges of criminal negligence or murder is an abuse of language and entirely unjustifiable'.

In the final report of the Committee<sup>1</sup> it was stated that:

'Whether there should some day be a united air service combining the Royal Flying Corps and the Royal Naval Air Service we are not in a position to say. However that may be, we see no reason against having one Equipment Department charged with the equipment of both the Army and Navy Flying Services. There would no doubt be inter-Service jealousy to contend with, but that should not be allowed to stop a much-needed reform.

'There could hardly be a stronger illustration of the need for a united equipment service than the fact that, at the beginning of the War, the manufacturing resources open to the two Services were divided between them without any possible knowledge of how the division would work out in practice, a division which in fact has given rise to many difficulties.

'We have seen how separate Equipment Departments for each Service led to friction in France, and how the friction ceased when one officer was sent there for both Services.

'A joint Equipment Department would, in our view, tend to abolish competition and friction between the Services and make for increased efficiency.'

Despite the vehemence of the attacks made on the Royal Aircraft Factory, Farnborough, the Committee found that the continued existence of the Factory was 'essential', but 'It should not, in our opinion, become a manufacturing establishment, but should confine its activities, as at present, to the five subjects stated in our Report, namely, (1) Trial and experiment. (2) Research. (3) Preparation of drawings. (4) Repairs. (5) Manufacture of spares.'

On May 17 Mr. Tennant announced in the House of Commons that an Air Board was to be appointed. This step arose out of a report which Lord Curzon had presented to the Cabinet in April. Mr. Tennant said that the function of this new body was at 'organize a complete system for the interchange of ideas on

<sup>1</sup> Final Report of the Committee on the Administration and Command of the Royal Flying Corps, &c. (Cd. 8194).

air problems between the two Services and such related bodies as the Naval Board of Invention and Research, the Inventions Branch of the Ministry of Munitions, the Advisory Committee for Aeronautics, the National Physical Laboratory and so forth'.

The Board was thus entirely advisory in character, and, in practice, acted throughout with a more complete knowledge of the military than of the naval side of the problem.

The Board, which was thus established under Lord Curzon's chairmanship, consisted of Lord Sydenham, Major J. L. Baird, M.P., and four Service members—the Third Sea Lord (Rear-Admiral F. C. T. Tudor), the Director of Air Services (Rear-Admiral C. L. Vaughan-Lee), the Director-General of Military Aeronautics (Lieutenant-General Sir David Henderson, K.C.B., D.S.O.), the Director of Air Organization (Major-General W. S. Brancker). The secretary was Sir H. Paul Hervey, and the assistant secretary was Commander R. M. Groves, R.N. The office of the Board was at 19 Carlton House Terrace, S.W.

The result of the investigations conducted by the members of the Board was to emphasize the need for co-operation in every direction. The Board was not prepared while the War was still proceeding to advocate amalgamation of the two Services, or the creation of an Air Ministry, although this seemed to its members to be the only solution of the Air Service of the future, having regard both to its Imperial aspects and to the great expansion to be expected, not only on the Service side, but in respect of commercial and other developments.

That the Admiralty was the main champion of the principle of the maintenance by the older Departments of the control of the two flying Services was no secret. Owing to the lack of executive power possessed by the Air Board it was unable to eliminate mismanagement and friction from the sphere of aircraft construction and purchase.

In a report presented in October the Board proposed among other things that the administration of the Royal Naval Air Service should be liberated from the different departments of the Admiralty and made self-contained, the chief being given a seat upon the Board of Admiralty, and that supply, design, inspection, and finance for both Services, as well as allocation of supply, should be vested in the Air Board itself. It was recommended that in other respects the duties of the Air Board should remain unchanged, that is, it should continue to discuss matters of air policy and to constitute a medium for the interchange of ideas

on air problems between the two Services and related bodies. Arrangements as to personnel, training, and operations should remain in the province of the Admiralty and War Office.

The proposal of the extension of the Air Board's power was accepted by the Cabinet, and early in December opportunity was taken, with the introduction of the 'New Ministries and Secretaries Act, 1916', to obtain the statutory powers which were considered to be necessary for the new Board. The Bill became law on December 22, and by 'The Air Board Order, 1917', which was made on February 6, 1917, the new and second Air Board was established and its composition defined, but it was not until April 29, 1917, that the House of Commons was informed of its composition and functions.<sup>1</sup> These matters will be discussed in a later chapter dealing with the policy of the Air Services in 1917.

Although the year 1916 witnessed a great struggle to develop our aeronautical resources, it must not be thought that the year did not bring progress either in the number or quality of *materiel* issued to the Services, for this was not the case. The trouble lay in the fact that not enough of the machines that were superior to those of the enemy were produced. Air mastery went in waves in France—in the early part of 1916 the enemy were our masters, in the summer we beat them, but in the winter of 1916–17 we were surpassed and beaten in the air.

The total home production of aeroplanes—single-seaters, two-seaters, experimental and twin-engined bombers—showed an increase of over 4,000 as compared with the previous year. The number of seaplanes was nearly doubled, and that of home-produced engines was nearly trebled.

The Royal Naval Air Service was not heir to so many troubles as their sister Service, and it can be said that many of the best machines used during the War had their origin during 1916. This happy result was due, undoubtedly, mainly to the policy of the Admiralty of fostering the enterprise of private contractors.

To turn to a description of some of the machines designed and produced for the Royal Naval Air Service during 1916, it should be said that because a machine was designed, accepted, and produced during the year, it did not by any means imply that it came

<sup>1</sup> For a detailed account of the events narrated in this chapter to this point, vide *The Beginnings of Organized Air Power*, pp. 21–94, and *The War Cabinet—Report for the Year 1917*, pp. 56–8.

into general use in the Service in the same year. The ever-pressing and menacing problem of supply prevented this (coupled with the inevitable alterations to design), with the result that, on an average, a period of 34 weeks elapsed between the first conception of a new design for a machine and its production in bulk, while the corresponding time for an aircraft engine was 64 weeks. The notice estimated to be necessary for a contractor to change from one type of machine to another was from three and a half to five months, and from one type of engine to another not less than six months. These facts explain in some measure why squadrons and air stations were frequently equipped with machines which, from the aspect of designs which had been approved, ought to be regarded as obsolete types. For instance, at Great Yarmouth air station pilots were flying machines at the end of the year which were little superior to those used by them in 1915.

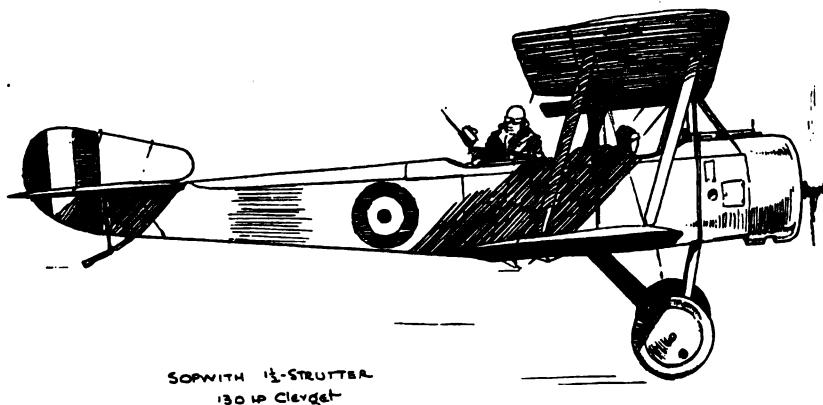
Of the machines that passed into the Royal Naval Air Service in 1916, some of the best were those designed and manufactured by the Sopwith Aviation Company, Limited.

Of the land machines the firm produced a two-seater known as the '1½-Strutter', so called on account of its unusual wing bracing. This machine has claims to historical distinction, not only for its capabilities for use as a fighter, but because, indirectly, it set a new fashion in aerial fighting, being the first British aeroplane to carry an interrupter gear which permitted the machine-gun to fire through the airscrew without hitting the blades. The machine was fitted also with the Scarff Gun Ring for the gunner. The 1½-Strutter was originally designed as a high performance two-seater fighter, with a 100 b.h.p. Clerget engine. At the time of its introduction it was regarded, and justly, as having an excellent performance and a good manœuvrability. Aerodynamically, it was of interest in being fitted with an air-brake in the form of adjustable flaps in the trailing edge of the lower plane adjacent to the fuselage. These flaps could be rotated by the pilot until they were normal to the wind, thus helping to pull the machine up when about to land.

A more successful innovation incorporated in this machine was the trimming gear, by means of which the angle of incidence of the tail plane could be altered during flight. In this manner the difference in weight of the passenger carried could be counteracted by the tail setting, and also the tail could be adjusted for high speed and climbing.

Originally designed as a two-seater fighter, the  $1\frac{1}{2}$ -Strutter was later adopted as a single-seater bomber. For bombing work it was equipped with a 130 b.h.p. Clerget engine, which afterwards took the place of the 110 b.h.p. Clerget in the standard two-seater fighter model.

A single-seater machine, the Pup, which also was a product of the Sopwith Aviation Company, passed into the Service during this year. This machine bore a 'family' resemblance to the Tabloid and  $1\frac{1}{2}$ -Strutter. It was equipped with the 80 b.h.p. Le Rhône engine. It was manœuvrable and had a lower landing



speed, and, because the pilot sat with his head below the level of the top plane, 'window panels' were fitted into this plane in order to enable the pilot to have a wider vision.

The majority of the seaplane work was still done by those machines designed by Short Brothers, and early in 1916 a new type, equipped with the 320 b.h.p. Sunbeam 'Cossack' engine, was produced to carry a torpedo or bombs, and then was fitted with additional petrol tanks to enable the machine to make patrols of long duration. It had a slightly higher speed than the '184' type and, like it, was fitted with folding wings.

The Fairey Campania was designed in 1916 by the Fairey Aviation Company, Limited, for reconnaissance purposes with the fleet, and was especially adapted to suit the conditions in the seaplane-carrier H.M.S. *Campania*. It was found, however, that seaplanes were not well adapted for use with the fleet. The carriers had to reduce speed, and stop when machines were hoisted in and out—frequently a dangerous manœuvre on account of the presence of enemy submarines, and as a result of this many

combined fleet and aircraft operations were a dismal failure in 1916. In consequence of these failures the practice of flying single-seater and two-seater aeroplanes from the decks and turrets of battleships, cruisers, and aircraft-carriers was instituted. Such machines had not a large radius of action, and, moreover, it was then considered undesirable to use land machines for long sea reconnaissances from coastal air stations, such as Great Yarmouth and Felixstowe, and therefore the Admiralty Air Department turned to the flying-boat as a solution of this particular problem.

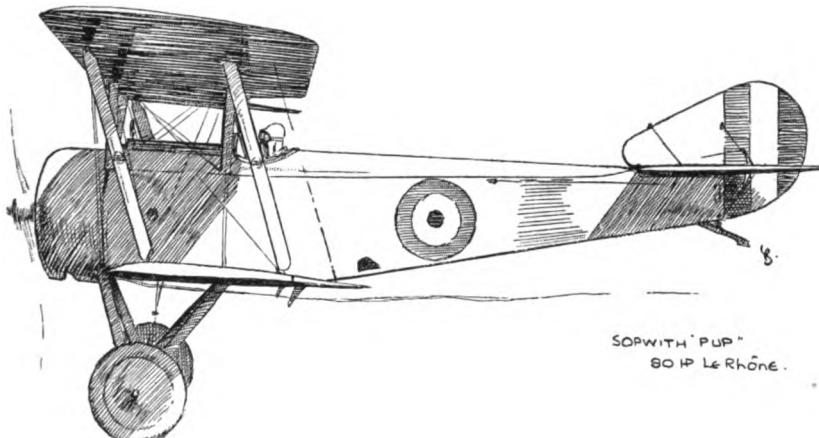
Although Mr. T. O. M. Sopwith had built the 'Bat-boat' in 1912 (and, accompanied by Lieutenant Spenser Grey, R.N., had won the Mortimer Singer Prize with it in 1913 for a series of flights starting from land and alighting on water and vice versa), the value of the flying-boat for naval purposes was not appreciated for some years. The particular qualities of this type of machine which made it so valuable for this class of work as compared with the float-seaplane are its greater seaworthiness, its superior facilities for observation purposes, and the greater comfort it can provide for the crew in flights of long duration, and, in the case of twin-engined machines, greater reliability, for no satisfactory, twin-engined float-seaplane was produced during the War. Generally speaking, the flying-boat is not so fast, nor has it the same ceiling, as float-seaplanes.

The general characteristics of a flying-boat are, as its name indicates, a partially enclosed hull upon which are mounted the planes and engines. The hull is of the hydroplane type, provided with one or more 'steps', and is subdivided by one or more watertight bulkheads. The planes (all the flying-boats built during the War were biplanes) are built above the hull, although the lower plane is usually built into the hull; wing-tip floats are fitted to the underside of the lower planes. The engine or engines are placed between the planes on either side, but close to the centre line of the hull. Some of the smaller flying-boats built during the War were 'pushers', but the larger ones were all twin-engined 'tractor' machines. The tail unit and rudders are well clear of the water, and the machine is controlled when in the air similarly to any other heavier-than-air machine.

Although little development work was done with flying-boats in this country before 1916, this was not the case in the United States of America. Mr. Glen Curtiss, one of the pioneers of American aviation, had, on January 10, 1912, at San Diego,

flown his first machine of this type. She was a 'tractor' machine, equipped with a 60 b.h.p. engine which drove two airscrews by a clutch and chain transmission. In July he produced his second machine—the 'Flying Fish', which one of his colleagues described as 'a real *boat*'. Starting with the 'Flying Fish', Curtiss, aided largely by some young American officers,<sup>1</sup> developed other types of flying-boats, culminating in the 'K' type, which carried successfully in flight three people. One or more of this type were purchased by the British Admiralty.

In July 1914 Mr. Rodman Wanamaker (an American who



controlled the large general store bearing his name) decided to finance an attempt to fly the Atlantic by means of a flying-boat 'in the cause of science and the interest of the world peace'. He asked Curtiss to design the machine and Lieutenant J. C. Porte, R.N., who had retired from the Royal Navy on account of ill health, and Lieutenant J. H. Towers, U.S.N., to be her pilots.

The flying-boat was duly built and was christened *America*. She was at first equipped with two 160 b.h.p. engines, but later another 160 b.h.p. engine was added; but this cut down her endurance.

The *America* never flew the Atlantic, for during her trials the War started and Lieutenant Porte returned to this country and to active service. The *America* was stripped and later was purchased by the British Admiralty.

Afterwards, in 1915, a limited number of Curtiss flying-boats came to this country for use in the Royal Naval Air Service, an

<sup>1</sup> Lieutenants J. H. Towers, P. N. L. Bellinger, and H. C. Richardson, U.S.N.

officer of which described them as 'comic machines, weighing well under 2 tons; with two comic engines giving, when they functioned, 180 horse-power; and comic control. And the stout lads who tried impossible feats in these usually had to be towed back by annoyed destroyers.'<sup>1</sup>

These machines were of the 'Small America' type, and their performance was stated to be inferior to the float seaplanes of the time. Later, the 'Large America'—the H. 12—was produced, largely on the advice of Lieutenant J. C. Porte. This flying-boat was similar in design to the 'Small America' but much larger. It had two Rolls Royce 'Eagle' engines (275 b.h.p.) driving two tractor airscrews.

The H. 12, although a good machine for the period, had many disadvantages for war purposes, which soon became apparent. The first of these drawbacks was her inability to rise from rough water without great risk of damage to her hull, because the design of the bottom was exceptionally weak compared with the robust construction of the hull, and especially was this so at the point where the tail portion joined the step, and unless very great care was exercised in both 'taking-off' and alighting there was a considerable possibility of the hull breaking at this point. This was a serious defect and greatly detracted from the usefulness of the machine, especially at an air station like Great Yarmouth, which did not enjoy the shelter of a harbour, and so the patrols made in these machines were, to a very great extent, governed by the weather at the base—an unreliable factor in the North Sea.

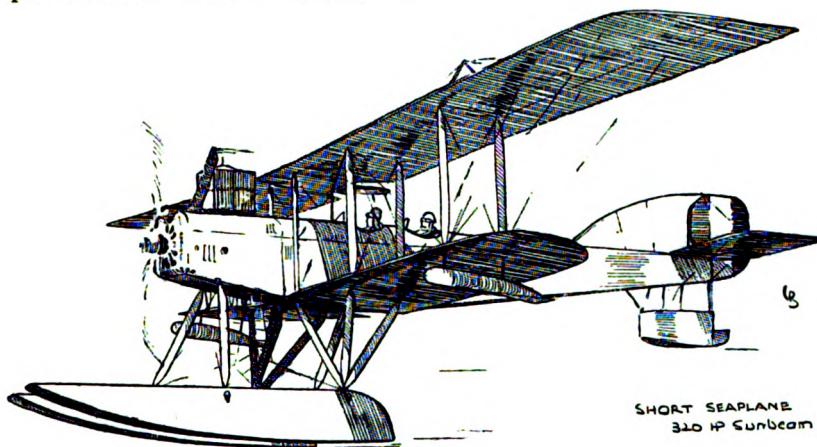
As a fighting machine the H. 12 was under-gunned for her size, and was at a disadvantage when attacked from below (where her guns were both totally 'blind'). Towards most other points behind her tail the after gun also could not be fired, for fear of damage to the tail plane, rudder, and elevator controls.

These and other disabilities led Wing Commander Porte and his staff at Felixstowe air station to conduct research into the improvement of the Curtiss flying-boats throughout the years 1915, 1916, and 1917, which research enabled them to produce the 'F' (Felixstowe) series of boats—F. 1, F. 2, F. 2a, F. 3, and finally the F. 5.

In addition to these flying-boats a considerable number of small, experimental pusher single-engined ones was built between 1915 and 1917. Amongst these may be mentioned the 'A.D.' (Air Department), equipped with the 200 b.h.p. Hispano-Suiza

<sup>1</sup> *The Spider Web*, pp. 21-2.

engine (built by the Supermarine Aviation Company, Limited); the F.B.A. (Franco-British Aviation Company), which was fitted with the 100 b.h.p. Gnome, and later with the Clerget and Hispano-Suiza engines; Norman Thompson, with the 140 b.h.p. Hispano-Suiza engine; the White and Thompson, with the 120 b.h.p. Beardmore and 130 b.h.p. Clerget engines. None of these machines was as successful as the Curtiss type, and they were only used on sheltered air stations on the English Channel because the hull form was such that they were quite unsuitable for operations in the North Sea.



The first flying-boat did not arrive at Great Yarmouth air station until April 1917.

The Admiralty also embarked on a very ambitious airship programme during 1916. New types of non-rigid airships were developed and several rigid airships were laid down; but as airships played no part in the operations conducted by the personnel of Great Yarmouth air station other books must be consulted for an account of this development.<sup>1</sup>

The question of the supply of engines was one of great difficulty, because in the spring of the previous year it had become evident that the development of the French Air Services would render it impossible for manufacturers in that country to cope with both our own and their home demands. The result of this was that by the middle of 1916 arrangements had been made whereby all types of French engines that were needed could be manufactured in this country. Apart from this, the development of

<sup>1</sup> *British Airships, Past, Present, and Future*, pp. 111-87.

English engines proceeded apace. The Sunbeam Motor Car Company, Limited, produced a 225 b.h.p. water-cooled engine—the 'Mohawk'—and a 200 b.h.p. 'Arab'. Rolls Royce, Limited, in the middle of the year, built the 75 b.h.p. 'Hawk', which was followed shortly afterwards by the 190 b.h.p. 'Falcon', which was eventually improved so that it developed 275 b.h.p., and it was out of this engine that probably the most famous of all wartime engines—the 'Eagle VIII'—of 375 b.h.p., was produced.

Although rotary engines were falling gradually into disfavour owing to their heavy lubricating-oil consumption, lack of reliability, and large head resistance, one engine of this class was designed during this year—the Bentley Rotary (generally abbreviated to B.R.) of 230 b.h.p.—an engine which gave excellent service in single-seater machines in 1918.

The engineer officer of Great Yarmouth air station has contributed the following notes on some of the troubles experienced with engines which were in use on the air station in 1916. He remarks that:

'We had a number of 70 h.p. Gnome engines fitted into Bristol Bullet single-seater biplanes. These machines invariably crashed owing to the petrol supply pipe to the carburettor breaking off, as the result of faulty method of fixing the drip trays which were arranged to catch any overflow of petrol and conducted it outside the fuselage. The engines themselves were quite a good job if well looked after. Valves gave a fair amount of trouble and the scraper rings fitted to the piston heads had to be carefully watched.'

*'Clerget Engines.'*

'In the early days considerable difficulty was experienced with these engines owing to the rapid deterioration of the scraper rings fitted on the piston heads. These rings were very apt to burn away and pistons to overheat, this trouble being aggravated by unsatisfactory piston rings. As experience was gained in the overhaul of these engines and the correct clearance for rings obtained, the number of hours flying time, between overhauls, was gradually increased until we had engines running anything up to 70 hours without being dismantled.'

'Difficulty was also experienced owing to there being insufficient clearance on the valve gear, which resulted in an occasional tappett sticking and the valve remaining open.'

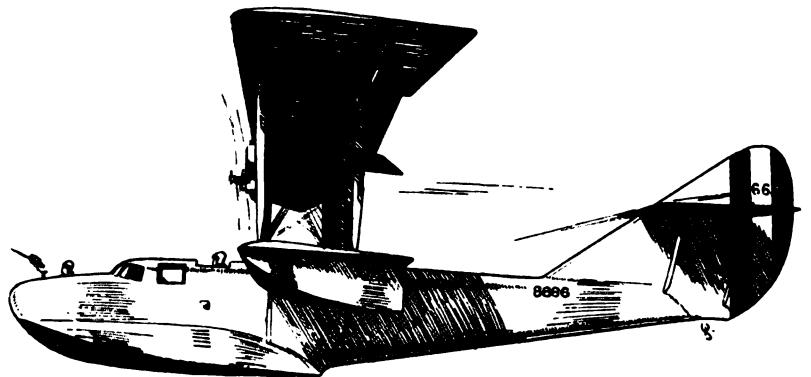
'A good deal of trouble that was experienced was also due to the fact that the pilots had to control the amount of petrol supplied to the engine, and they were often so busy with flying that they had no time for engine controls.'

*'Sunbeam Engines.'*

'At first a great deal of difficulty was experienced with these engines, but this was almost invariably connected with the accessories as apart from the

engine itself, the original 150 h.p. and 225 h.p. engines were a good reliable job mechanically, and when fitted with genuine Bosch magnetos, could be depended upon to give good service. But the magnetos were fitted in between the cylinders and so got very hot, and almost every other type of magneto which was fitted would give trouble after a few hours, and it was quite a common occurrence for a Short seaplane to be towed home with engine trouble, which was invariably traced to the magneto.

'I remember, on one occasion, that we had a message from a Coastguard station up the coast, to say that the "morning patrol" had landed on the beach and was requiring a new magneto. This was dispatched by a second machine who did not turn up. A third machine went to the rescue and this also failed. Eventually, a rescue party was sent by road with a whole batch of magnetos, and the machines in due course arrived home.



'Another attachment to the engine which invariably gave trouble was the wireless drive. The generator was fixed in the fuselage and driven by direct shaft from the engine. Unfortunately, no allowance was made for the fact that when in flight the engine moved slightly forward in its housing, and in many cases this forward movement put so much strain on the wireless drive that it failed after a few hours. This defect was pointed out, with a suggestion that a telescopic shaft should be fitted. This was duly considered, and a new telescopic shaft was provided for the wireless drive on these machines shortly after the engines in the machines had become obsolete!

'These early engines were followed by various improved models which gave a bigger horse power for the same cylinder size. They had also overcome the defects of the original magneto position. Incidentally, they had introduced some special troubles of their own, the chief among these being the K.L.G. plugs. The design of the cylinder head was such that only these plugs could be used, and the insulation was inadequate to stand up to the high temperatures and explosion pressures which these engines developed. This was a source of endless trouble, and it was by no means uncommon for an

engine to be working perfectly on the slipway and yet the machine would fail to take off the water owing to plug trouble having developed, and on one occasion this occurred with six consecutive machines, all of which tried to start off on the early morning patrol. This plug difficulty was eventually overcome, and with increased engine power a further defect developed, i. e. the burning of exhaust valves, and many a machine only just got home, owing to the engine power having dropped appreciably from this cause. Much time and money was spent in developing special steel alloys for these valves, but even at the end of the War some trouble was still being experienced.'

It was in 1916 that great development took place in aircraft armament. The Vickers machine-gun was adapted to aerial purposes by changing the water-jacket to an air-cooled one and by lightening the gun in other ways. A similar course was adopted with the Lewis gun, namely, the removal of the large barrel casing and radiator fins used in the land gun, for it was found to operate satisfactorily in the air with the bare barrel. The Vickers gun, fitted with an interrupter or synchronizing gear, came to be used as the pilot's gun, and the Lewis as the observer's.

Considerable development took place in sights for these guns, as those originally supplied with them were unsuitable for use in the air, because no means were provided for estimating the allowance to be made to compensate for the velocities of 'own' and 'enemy' machines. Both the Royal Naval Air Service and the Royal Flying Corps adopted the 'ring' or 'graticule' system of estimating allowances for enemy speed and evolved sights similar in principle but differing in their method of use. With a fixed gun firing through the airscrew no allowance was necessary for 'own' speed, as the axis of the sight was in the direction of motion of the machine, but with movable guns correction was necessary for both 'own' and 'enemy' speeds. The ring sight took the form of a thin circular band of metal having a smaller, concentric circle within it. The radius of the ring was arranged proportionately to its distance from the observer's eye to give the correct deflection for the enemy's average speed. With a fixed gun this ring sight was used in conjunction with a bead sight, consisting of a bead mounted at the top of a pillar. By alining the bead with the centre of the ring the line of fire is given, and to ensure that the enemy's line of flight intersects the line of fire the gunner must manœuvre until the hostile machine is apparently running directly towards the centre of the ring and the bead placed central thereto. Aim is then taken by placing the target within the ring.

To allow machine-guns to be employed efficiently they must needs be effectively mounted, and the 'Scarff Socket and Pillar Mounting' was gradually supplanted by the 'Scarff Ring Mounting'. The first of this type, known as the 'Scarff No. 1', was an ingenious device. It was fitted with a compensating sight which allowed for the correct amount of deflection for 'own' and 'enemy' speeds being applied automatically. At the period of its introduction it was looked on as a great invention, and was a considerable advance upon anything previously employed, but owing to lack of facilities for training in its use, and to the fact that it was not generally understood, it fell into disuse in favour of the 'Scarff No. 2 Ring Mounting'. This was first fitted to the Sopwith 1½-Strutter early in 1916, and provided for freedom of movement of the observer's gun, hitherto unobtainable on any other mounting. From that date this mounting was in almost universal use by the British and Allied Air Services, and is so to this day—1928.

The mounting consists of a fixed ring fitted round the top of the observer's cockpit; rolling on this ring is a movable ring on which an elevating bridge is carried, the weight of the machine-gun or guns being suitably balanced against gravity by means of elastic cord. The observer sits within the ring, which is capable of rotation in any direction. The elevating arm enables the gun to be brought above the observer's head for firing upwards or depressed to the level of the fuselage for firing downwards; thus the gun is easily manœuvred into any position for offensive or defensive purposes by a simple manipulation of a single lever, the mounting being locked at will. In later practice two guns were fitted to these mountings arranged to fire simultaneously and parallel to each other. To facilitate the fitting of two guns in a better manner than was possible on the 'Scarff No. 2 Mounting', the 'Scarff No. 6' was invented. To overcome the difficulty of moving the mounting against the slipstream of the airscrew, which became more apparent as the speed of machines increased, a wind-balancing gear was provided which relieved the observer of much fatigue at high altitudes. This mounting, though in production at the time of the Armistice, did not come into use on active service during the War.

It has already been told how the advance of aerial fighting towards the end of 1915 emphasized the need for a machine-gun capable of firing straight ahead through the blades of a rotating airscrew, and how steel deflector plates were affixed to the blades, and how Fokker, by bringing out a mechanical device for inter-

rupting the fire of a machine-gun, enabled the German Air Service in the spring of 1915 to achieve a tactical success of the first magnitude.

Before attempting to describe our various replies to this device it were as well to differentiate between an interrupter gear and a synchronizing gear, for, while both achieve the same object, they differ in principle. The former may be described as a device for preventing the machine-gun firing at all, save and except at the times when it is desired that it should do so—that is, when the blades of the airscrew do not foul the line of flight of the bullet. The latter gear is one which actually fires the gun at this desired time.

Various inventors in this country devoted their attention to the solution of this problem, and in the November and December of 1915 Vickers Limited started work (under the direction of the Director-General of Military Aeronautics) with a mechanical interrupter gear. In December their labours were successful, but there was a delay in the introduction of the gear because the Army could not spare the Royal Flying Corps many Vickers guns, and in the Lewis gun the masses which have to be accelerated are so heavy that the gear could not be fitted to it with success. In February 1916 the extreme shortage of Vickers guns had been partially overcome, and some Bristol machines were fitted with the Vickers interrupter gear and sent out to France.

In April 1916 another mechanical gear—the Scarff-Dibowski—appeared. This device, which was somewhat similar to the Vickers gear, was originally designed by a Russian—M. Dibowski—and developed in conjunction with him by Warrant Officer Scarff; several Sopwith machines for the Royal Naval Air Service were fitted with this gear. The operating mechanism consisted of a cam driven by the engine which operated the trigger of the gun through a series of push rods.

This gear was successful, but was superseded by the Sopwith-Kauper gear which, while different in construction, was similar in conception. By July 1916 mechanical interrupter gears were in production, but they all suffered from the disability of all link motions, namely, wear (and consequent 'backlash') and the troubles inseparable from exposure and contraction due to rapid changes of temperature when flying at different altitudes and varying climatic conditions.

As a result of these defects a hydraulic gear was proposed to Major Bertram Hopkinson by an officer of the Department of

Military Aeronautics (Captain L. V. Stuart Blacker of the 12th Frontier Force Regiment, 5th Battalion (Queen Victoria's Own Corps of Guides), and of the Royal Flying Corps).

A little later M. Constantinesco, a Rumanian engineer of distinction who had for some years studied the problem of the transmission of energy by means of wave motion in a confined liquid, appeared on the scene. During the early part of the War he had submitted several inventions to the authorities, but by a curious chain of circumstances a Major C. C. Colley of the Royal Field Artillery was able to bring him into closer touch with them. Major Colley had been severely wounded in France, and in 1916 was acting as a foundry inspector at the Royal Arsenal, Woolwich. One day, in his own words:

'I was limping towards Charing Cross station with my bag of sample test-pieces to catch the train to Woolwich, when I received the most clear and distinct "urge" that it has been my lot to experience, and it was at the same time the most bewildering. It was to the effect that I must immediately go down the right-hand side of Whitehall and salute *the first man I met without a hat*. The urge was so unmistakable that I had perforce to obey. I proceeded slowly down the right-hand side of Whitehall, and when I had almost reached the War Office I did indeed see an elderly naval officer carrying his hat in his hand—it was a hot day—so I duly saluted him. He returned the salute but took no further notice. I then received the "urge" to follow him at all costs; this I did until, in a rage, the poor old man turned round with a tirade of abuse and demanded my name and regiment. Just as he was putting my name down in his note-book, he looked at me and said, "Are you the same Colley who submitted an electric level to the Admiralty in 1913?" I said I was; he replied, "You are just the man I want. Go to room . . . Admiralty, and ask for Captain . . . R.N., and tell him 'Jacky Fisher' sent you and that he has to apply to the War Office for your services in joining the new Invention Board. I want a soldier (and a gunner) to keep in touch with the Navy and so 'liaise' or exchange inventions which may be suitable—will you take on the job?" Within a week I became Chief Experimental Officer and Artillery Adviser of the Munitions Invention Department—an ideal position for my particular sphere of usefulness as future events will show.'

Some time later:

'a suggestion to heat the trenches by means of "Wave Transmission" was submitted to the department, and when it was placed before the committee it received very little consideration because the inventor had stated *that water was compressible*. Sir J. . . . immediately turned the invention down as not worthy of serious consideration "because water is incompressible". It was stated that the invention was submitted by "A mad Rumanian", and

the whole question was dismissed by the Chairman's remark, "Well, in any case, British Tommy doesn't suffer from cold feet", meaning, of course, "fear", and thus the case was dismissed.

'I happened to be sitting next to the Secretary and his pile of dossiers or files had increased so high that when he placed this file of Mr. Constantinesco's on top the whole over-balanced, and in my effort to prevent them falling on the floor the Wave Transmission file slipped on to the pad in front of me. Being disinterested with the rest of the proceedings, I opened the file and began to read the theory of Wave Transmission. I was so interested in the inventor's claims that I took charge of the dossier. Next day I made an appointment with Mr. Constantinesco and went to his laboratory at Alperton, and was so impressed with what I saw that I reported the matter at the next committee meeting and urged that the case should be reconsidered. I was asked what useful purpose the invention would serve—and was unable to specify any definite use for the invention. I was then informed that the invention had been definitely turned down and that I was not to encourage the inventor, and that no official funds could be expended for investigation or research upon this invention. I was so incensed at the attitude of my department that I fear that this was the cause of my ultimate leaving, because at an interview with the Comptroller, I definitely asked for a written order to the effect that I should have nothing to do with the invention in my official capacity. This I received in due course, and later I received orders from the War Office to join a battery.

'I had in the meantime many interviews with Mr. Constantinesco in an endeavour to see in what manner his invention could be put to practical use in war. He suggested many, one of which was the silent firing of projectiles varying in size from the Mills grenade to the 250-lb. stick bomb, all of which he successfully achieved. It was during one of our many interviews that I suggested his attempt to so synchronize the firing of a machine-gun that, when mounted on an aeroplane, the bullets would not strike the propeller. I do not know what gave me this "brain wave" (I had nothing to do with aircraft at the time), but as soon as I was assured by Mr. Constantinesco that he could construct such a device, I called (unofficially, of course, since I was ordered to have nothing to do with Mr. Constantinesco) on the Flying Corps and ascertained that such a device would be invaluable. That department was in a state of transition as the Royal Air Force was on the point of formation, and had no funds available for research, and no spare equipment. I decided, therefore, to go to the Arsenal and see my old friends . . . thereupon I drove to Woolwich, where I managed on my own "note of hand" alone to obtain the loan of a Vickers machine-gun and 10,000 rounds of ammunition; this I took to the Flying Corps and placed them in touch with Mr. Constantinesco.'

Major Colley introduced M. Constantinesco to Lieutenant-Colonel W. B. Caddell, R.A., Major Bertram Hopkinson, and Captain Blacker, all of whom were officers of the Department of

Military Aeronautics. M. Constantinesco explained the principle of his synchronizing gear and had one in operation at Wembley in May (1916).

M. Constantinesco had no funds, and Major Bertram Hopkinson, after witnessing some trials with the gear, gave him, on his own responsibility, an order for twelve gears at £50 each, and with that capital he was able to perfect his device, and Major Hopkinson, by his foresight, gave the flying Services the most successful of all synchronizing gears.

The gear involved a pressure pump (for imparting the wave transmissions), an attachment in the gun, another on the engine, and a copper pipe and feeding apparatus connecting them; the liquid was a mixture of oil and paraffin. The first machine to be fitted with this gear (which came to be known as the 'C.C.' gear) was a B.E. 2c, and trials were conducted in August 1916 with gears running at various engine speeds. Eventually, successful results were obtained with the gear running at twice the engine speed, which ensured that the rate of fire was not appreciably diminished with a falling off of engine revolutions. Synchronizing gear was only fitted to the Vickers gun, for, as already stated, the masses which have to be accelerated are too heavy in the Lewis gun. Owing to difficulties of manufacture the C.C. gear did not come into general use until the middle of 1917.

As 1916 saw the height of the German airship campaign, it is not surprising that a considerable amount of research was directed to the production of a bullet which would be capable of igniting the hydrogen in the gas-bags of an airship. The ordinary small-arms ammunition (0.303 inch) was of little use, as the rate of leakage through the holes that they could make in the gas-bags was small compared with the total volume of gas; moreover, such bullets could not ignite the hydrogen or the fabric of the bags. The problem was a difficult one, for explosive bullets by themselves are of no use, as they will not ignite near hydrogen. Tracer bullets were found also to be equally useless. At the end of 1914 Mr. Buckingham evolved a phosphorus-filled bullet, and before the end of 1915 an incendiary bullet, the 0.303 inch with a tracer range of 700 to 1,000 yards, was produced. About the same time the Royal Arsenal, Woolwich, was experimenting with a tracer bullet, and the S.P.G. bullet was produced and issued to the Services early in 1916. Another incendiary bullet—the Brock—was also produced in 1916, but no known explosive bullet would explode on the *fabrics* of an airship until the Pomeroy

bullet arrived. At first this bullet would only function in large calibres (0.45 inch), and this caused delay as no machine-gun was available to fire such large cartridges; the 0.45-inch Maxim was tried but it, and its ammunition, was too heavy. Many experiments had to be made before the Pomeroy bullet would work in the 0.303-inch calibre with a *nickel jacket*. The crux of the difficulty was that if the bullet was made too sensitive it detonated in the gun with disastrous results, and if not sensitive enough it would not explode when it struck fabric. After a series of experiments the problem was found to be even more difficult, for, in order to set alight to, say, a Zeppelin airship, the bullet had to pierce the outer cover but *without* exploding, and then explode on the surface of the gas-bags. The problem was, however, solved in 1916, and the resulting Pomeroy bullet, mixed with the Royal Arsenal tracer bullets, came to be the standard anti-Zeppelin airship ammunition.

Important developments also took place in 1916 in aircraft bomb gear, principally in the introduction of the Skeleton type of bomb release-slips and carriers, and the principle of vertical stowage of bombs inside the fuselage of machines. The Skeleton type of carriers was made in three sizes, 112 lb., 250 lb., and 520 lb., and was very light and of low head resistance as compared with other carriers. The 520-lb. type, for instance, weighed 16 lb., whereas the Woolwich type 520-lb. carrier weighed 90 lb.

In the method of vertical stowage the bombs were hung by the nose on release-slips mounted on beams, the bombs being steadied when in place and guided during their fall in cellular compartments.

The bombs used by the Royal Naval Air Service were intended mainly for the destruction of submarines, and were constructed on the 'mine' principle, namely, the explosion under water of a light case containing a heavy charge of explosive. This was opposed to those used by the Royal Flying Corps, which were designed on the 'shell' principle of a heavy case with a small charge whose destructive effects depends mainly on the fragmentation of the case.

The design of the bombs intended for the use of the Royal Naval Air Service had, in the end, to be a compromise between the two types, as a pilot might sight, and be in a position to bomb a submarine and a surface-borne craft like a cruiser or destroyer—in which case for the former he would need one of the 'mine' type, while a 'shell' pattern was required for the latter.

In wireless telegraphic apparatus considerable progress was made during the year. The sets available were mainly Rouzet 400 watts, and aeroplanes were telegraphing up to 60 miles and in Short seaplanes for a slightly greater distance. The year also saw extension in the use of Ground Directional Finding sets, which were of value in combating hostile airship raids. Continuous wave sets were also developed during the year.

By the middle of 1916, R.A.F. Mark II, a compass adapted for use in an aeroplane, had been evolved from a purely nautical instrument. The faults of the original flat compasses for aeronautical work were partly due to the engine vibration, which would sometimes give a steady deflection of some  $40^{\circ}$ , but the most difficult problem to solve was the failure of this type of compass to register turns off north under certain conditions. When turning with a heavy bank, the card in any compass remains parallel to the plane of the machine, the consequence being that the effect of the horizontal component of the earth's force diminishes with the angle of bank, and that of the vertical component increases. The north end at once has a tendency to dip and the instrument is no longer a compass in the ordinary sense. This difficulty was mitigated in the 'upright' type and in the Lucas Mark II R.A.F. (named after the late Doctor Keith Lucas, F.R.S.) by giving the card a very slow period of swing. The working of both these types gives an appearance of extreme sluggishness. A quicker period had to be introduced into the upright type, and the danger of the northerly 'turning error' had to be accepted as an unavoidable nuisance. These compasses, in conjunction with an instrument called a turn indicator developed during 1918, enabled a pilot to steer a straight course through clouds. Directional wireless was not evolved in time to be of use in this connexion during the War.

The importance of well-trained personnel was not lost sight of during 1916. In November 1915 a scheme for the establishment of a large central school of similar function to the Central Flying School, but for Royal Naval Air Service personnel alone, was proposed. The scheme provided for the training of pilots for aeroplanes, kite-balloons, free balloons, and small airships, as well as for instruction in bomb-dropping, armament, gunnery, torpedoes (as applied to aeronautics), wireless telegraphy, and navigation. The outcome of this scheme was the establishment of the Training Stations at Cranwell and Frieston early in the year 1916. Towards the end of the year arrangements were made to

open another station in the centre of France at Vendôme. Officers were still trained at the stations at Chingford, Calshot, and Lee-on-Solent. During this year the rank of Observer Officer was created, for it was found that the work of observation needed especially trained men—as one Admiral has remarked:

‘But—and a big but—we must not forget that the observer is only second in importance to the dashing pilot. A good observer is worth his weight in gold to the Admiral in the absence of photographic reconnaissance. His qualifications for coast work are most varied. He should distinguish between classes of vessels. Frequently I have had destroyers reported as battleships, nor is the mistake one easy to avoid, without concentrated attention to comparative detail. He should be able to judge of movements of troops, to spot, to pick up detail, and should possess many other virtues. There are a few hundred first-class pilots for each really first-class observer.’<sup>1</sup>

<sup>1</sup> *The Dover Patrol, 1915-1917*, vol. ii, pp. 575-6.

## XIV

### THE ACTIVITIES DURING 1916 OF THE GERMAN AIR STATIONS OPPOSED TO GREAT YARMOUTH AIR STATION

**D**URING 1916, as in the previous year, the main activity of the Imperial German Naval Air Service was shown by its airships, for they made many raids on England and France and kept a constant watch over the North Sea.

On no less than 22 separate occasions during that year did they raid England; Scotland was raided 3 times; Wales and Ireland were never attacked from the air during the War.

The greatest number of raids was made during April and the smallest in January, October, and November. A raiding airship was usually in the air for about 20 hours.

From these airships 3,438 bombs were traced as having been dropped on land. The casualties inflicted by these missiles were 193 killed and 681 injured.<sup>1</sup> The material damage inflicted was, however, not very serious. The enemy suffered very heavy losses, for one Schütte-Lanz and 7 Zeppelin airships were destroyed by us. As a result of our defensive measures the commanders of these airships were forced to raid at a greater height than in 1915, and this helped to make accurate bombing a much harder task.

It is difficult to give a comprehensive answer to the question as to whether or not the airship raids were a success. From the point of view of inflicting material damage, they must be adjudged a failure—and many German authorities have concurred with this view since the Armistice—but the raids were an undoubted success from the point of view of absorbing and partially immobilizing man- and gun-power in this country.

As a result of these attacks we were compelled to retain at home (in addition to the naval air units along the east coast) 12 squadrons which could otherwise have been sent overseas. These squadrons alone absorbed 200 officers and 2,000 men; in fact, at the end of 1916, no less than 17,000 officers and men were retained in this country for anti-aircraft defence duties. The number of guns and searchlights required was considerable, for at the end of the

<sup>1</sup> Vide also *The German Air Raids on Great Britain, 1914-1918*, pp. 266-8.

year there were 400 anti-aircraft guns in this country—at a time when every gun was needed overseas. In addition to the personnel required for anti-aircraft defences large numbers of troops were retained in this country to repel any landing of troops that the enemy might attempt; in fact, in 1916 a total force of nearly 500,000 men was kept at home to provide garrison troops and anti-aircraft defences.

Another effect of the raids was to cause delay in railway traffic, for during a raid most of the trains used to stop running in the area attacked, and if a raid lasted for some hours the resulting delay was a very serious matter.

It was found also that the raids had a serious effect on the production of munitions of war; for instance, an informed report states that:

'In 1916, hostile aircraft *approached* the Cleveland district in thirteen different weeks—which reduced the year's output in that district by 390,000 tons (of pig-iron) or one-sixth of the annual output. In certain armament works it was observed that on the days following raids, skilled men made more mistakes in precision work than usual, the quality of the work done was inferior, while air raids made a constant output impossible.'<sup>1</sup>

The German General Staff, at the end of 1916, reviewed the results achieved by these airship raids and came to the conclusion that they were a failure, and reported that 'since an airship raid on London has become impossible the Air Service is required to carry out a raid with aeroplanes as soon as possible'.<sup>2</sup> The proposal to use aeroplanes for raiding this country had been raised in the spring of 1915 and in the middle of 1916, but, as there were no machines capable of performing satisfactorily such an arduous duty, the proposal had to be shelved. By the end of 1916 conditions had improved, and the enemy had aeroplanes that had the necessary weight-lifting powers and endurance.

This new task was given to the military arm of the Air Service, and not to the naval, for three reasons, namely:

- (1) A certain antagonism between the naval and military commands.
- (2) The lack of a suitable type of seaplane. The design of the seaplane of the period was unsuitable as the floats were too heavy, and hence the bomb load carried would have been too small.
- (3) The fact that it was impossible to detail a sufficient number from the existing seaplane crews to undertake this special work.'

<sup>1</sup> *Paris or The Future of War*, p. 46.

<sup>2</sup> Vide an article in the issue of *Die Luftwacht*, May 1927, entitled 'Die Angriffe des Bombengeschwaders 3 Auf England', by Major a. D. Freiherr von Bulow.

The trials of the 'Giant Aeroplanes' which were held in the autumn of 1916 were a success, and as a result the General Officer Commanding the German Military Air Service (General von Hoeppner) ordered preparations to be made to bomb Great Britain. Two schemes were prepared, one using squadrons equipped with 'G' bombers, and two 'giant flights' using 'R' bombers. All the schemes for these operations were very secret and were given a code name *Turkenkrenz*.

The enemy had made some aeroplane raids (25 altogether) on this country before this decision, but they were feeble affairs and inflicted very few casualties and practically no damage.

Although the personnel of Great Yarmouth air station played a considerable part in combating the menace of the airship raids, they took no similar part with the aeroplane raids, as this task was delegated to the pilots of the Royal Flying Corps and to the ground defences.

While the Zeppelin airships failed as a raiding weapon, they were remarkably successful in 1916 in maintaining an effective watch over the North Sea and preventing our naval forces from effecting surprises. Daily patrols were established to the Norwegian coast, to the Moray Firth, and in the Bight of Helgoland. During 1916 the average duration of these patrols was 24 hours. Owing to the weather conditions airships were not able to take part on the first day of the Battle of Jutland, only on the second day, but on the majority of occasions when the High Sea Fleet did leave their bases they were usually accompanied by a cordon of airships.

So experienced an authority as Admiral of the Fleet Earl Jellicoe has said that 'the German Zeppelins, as their numbers increased, were of great assistance to the enemy for scouting, each one being, *in favourable weather*, equal to at least two light cruisers for such a purpose'.<sup>1</sup>

Admiral Scheer, while paying tribute to the value of airships for fleet purposes, remarks that 'scouting by airships is, in any case, somewhat negative in character, since the fleet is only informed by them that the main hostile fleet is *not* within their field of vision, whereas the important thing is to know where it actually is'.<sup>2</sup>

A senior officer of the American Navy, Rear-Admiral W. A. Moffett, Chief of the Bureau of Aeronautics, in a statement to a Congressional Committee, quoted what he said was part of a

<sup>1</sup> *The Grand Fleet, 1914-1916*, p. 32. The italics are in the original text.

<sup>2</sup> *Germany's High Sea Fleet in the World War*, p. 185.

secret report, dated September 20, 1917, prepared by the British Admiralty, giving its views on the work of Zeppelin airships at the Battle of Jutland. The excerpt ran as follows:

'From the results already given of instances, it will be seen how justified is the confidence felt by the German Navy in its airships when used in their proper sphere as the eyes of the fleet. It is no small achievement for their Zeppelins to have saved the high-seas fleet at the Battle of Jutland; to have saved their cruiser squadron on the Yarmouth raid, and to have been instrumental in sinking the *Nottingham* and *Falmouth*.'<sup>1</sup>

Perhaps the best commentary on the services rendered by Zeppelin airships to the High Sea Fleet is that during 1916 we started to build a very large number of non-rigid and rigid airships for use with the Royal Navy.

The activities during 1916 of Borkum, Norderney, and Zeebrugge air stations were concentrated mainly on attacking submarines of the Royal Navy operating in the Bight of Helgoland.

No less than 5 officers were appointed to the command of Borkum air station during the year. Oberleutnant zur See von Tschirschky was the Commanding Officer at the beginning of the year, but afterwards the following officers held this position: Oberleutnant zur See Hans Geisler, Oberleutnant d. R. Dehn, Oberleutnant zur See Lorenz, and finally Oberleutnant zur See Frege.

In January the captured steamer *City of Bradford*, which served as quarters for the officers and men of Borkum air station, was carried away by a very high tide, and as a result was so badly damaged that she had to be towed to Emden for repairs. This accident made the housing problem very acute, and special quarters had to be built ashore. The average number of men on this station during the year was about 200; only 3 officers and 2 men were killed. In January there were 11 machines, and this number progressively increased until there was a maximum of 20 in December—the total of machines lost during the year was only 10. The number of 'war patrol' flights made was 664, but on no occasion did the pilots of any machines from this station attack machines of the Royal Naval Air Service. In fact, the 'principal events' of the year were very small, as can be seen from the following excerpt from a German official document:

- '1916. 20. 2. Dropped bombs on English submarine.
- 11. 5. Dropped bombs on submarine in Hubertgat.

<sup>1</sup> August 19, 1917. Vide *The Grand Fleet, 1914-1916*, pp. 438-47; *The World Crisis, 1916-1918*, Part I, pp. 161-4.

- '1916. 3. 7. In 097 e dropped bombs on submerged submarine.
- 29. 8. In 020 e dropped 9 bombs on English submarine.
- 19. 9. Dropped 8 bombs in 062 e on submerged submarine.
- 22. 10. In 018 e dropped bombs on 20 enemy destroyers and torpedo boats steaming on a westerly course. Machine fired at.'

Oberleutnant zur See Mans remained in command of Norderney air station until June, when he was succeeded by Oberleutnant zur See Schiller. His place was, however, taken in November by Oberleutnant zur See Friedensburg. Throughout 1916 this air station remained exclusively a training station.

Kapitänleutnant von Tschirschky von Boegendorff was appointed to the command of Zeebrugge air station early in January, at a time when the strength of the flying personnel was 22 and the number of men was 181; there were 16 machines on the station. Owing to the increase of flying operations at this station, the building of additional sheds was started early in the year. These were finished at the end of 1916 and were then used to house the torpedo-carriers which operated from this station; a 10-ton crane also was brought over from Bruxelles and erected on the Mole for handling these machines.

The personnel of Zeebrugge air station claimed to have done a great deal of useful work during 1916, but as this does not directly concern the story of the events connected with Great Yarmouth air station it will not be given in detail. It may, however, be said that it was claimed that pilots from Zeebrugge shot down 10 machines belonging to the Allies and to have made 1,183 'war flights'. Three officers were killed during the year and two wounded, including the commanding officer. The average number of machines on the station throughout the year was about 22 and only 17 were lost.

Considerable improvement took place during 1916 in the equipment of the seaplane side of the German Naval Air Service. The 150 b.h.p. Mercedes and the Benz engine of the same power were produced and fitted into the Friedrichshafen seaplane, thereby improving its performance. Practically all these machines were equipped with a machine-gun and wireless telegraphic apparatus. Several Brandenburg and Sablating machines were also issued, but in general Borkum and Norderney were not so well equipped as Zeebrugge and Courland.

During 1916 a synchronized Spandau machine-gun was fitted into the seaplanes that were in use. This was in addition to the observer's gun, which was mounted on a form of Scarff ring.

In the 100 and 120 b.h.p. seaplanes only five 5-kg. bombs were carried, but in the 150 and 160 b.h.p. machines the number of bombs of this weight was increased to ten. When submarine hunting 'five bombs were always dropped in succession to ensure a hit'. When seaplanes equipped with the 200 b.h.p. engines appeared the weight of the bombs was increased to 10 kg., because the 5 kg. were found to be of little use.

It has been stated already that at the beginning of the War 'Carbonite' bombs were used (they were carried in baskets under the observer's seat and dropped by hand), but in 1916 these bombs were replaced by a different type known as the 'P. und W.', which continued in use to the end of the War. They were torpedo-shaped and were fitted with slanting vanes which not only acted as an air-drag to keep the bomb nose down, but also imparted a rotary motion to the falling bomb, and so enabled the German designers to replace the propeller as an arming device by centrifugal bolts, on the same principle as those of gun fuses. As the height at which bombs were released had by that time greatly increased, the additional time required for the arming of the fuse was of no importance. Time fuses were also employed, chiefly for obtaining delay effects after impact.

The standard sizes of these 'P. und W.' bombs were the 12.5-kg. (27-lb.)—a thick-walled bomb with instantaneous fuse—and the 50-, 100-, 300-, and 1,000-kg. 'mine' or thin-walled bombs, with bursters respectively of 23 kg., 60 kg., 180 kg., and 680 kg.

The length of one of the 300-kg. (660-lb.) bombs without its loop and stabilizing cap was 1.20 metres (approximately 4 feet), the greatest diameter was 50 centimetres (20.8 inches), and the weight of the explosive charge about three times as great as that of the heaviest of German naval high-explosive shells.

Great attention was devoted by the German authorities to the subject of bomb sights. The Zeiss telescopic sight was issued in 1915 and was afterwards improved, and the new instrument was called an 'aircraft aiming-tube'. The observer noted by a stopwatch the time in which a ripple or wave below the machine passed across a certain part of the scale in the aiming-tube, then, knowing this time and the height of the machine in which he was flying, he could, by consulting a table, set his sights for the correct aim. For night-bombing operations a special Goertz sight was used. Towards the end of the War a Goertz-Borjkow 'aiming-tube' was employed; this instrument determined the

correct moment for the releasing of a bomb by means of a clock-work mechanism.

Perhaps the most striking development made in the German Naval Air Service during 1916 was with torpedo-carrying aircraft. This work has been traced in a German history, of which the following is an excerpt:

'At first, efforts were made to attach torpedoes beneath single-engined land aeroplanes capable of flying short distances over the sea. The idea was that the torpedo should obtain its initial velocity from the actual speed of the machine, and should be discharged at short range against any hostile ship. Bronze torpedoes were also constructed for reasons of weight economy, and were carried by single-seater land machines. However, one could hardly expect any of these methods to prove successful. The enemy was soon able to recognize such machines, and, quite apart from that fact, taking off from land with a live torpedo aboard was certainly not free from danger. Nothing therefore ever came of the torpedo-carrying land machine. We then tried to build aeroplanes which were able to fly long distances over the sea and carry a heavy torpedo and two men, the pilot and the torpedo man. This could never be done with only one engine, and the result was the construction of twin-engined seaplanes for this purpose. The discharge of the torpedo was to be effected by the velocity of the machine, and it was quite expected that the aeroplane would be lost if it crashed on landing while still carrying the torpedo. One had to be resigned to a short life and no seaworthiness. On account of the necessity for economizing weight the construction of the machine had to be exceedingly frail, as otherwise even two 100 h.p. engines were not able to carry the heavy torpedo.'

'Things were made more difficult by the fact that anything linking up the two floats, such as was fitted to the normal seaplane, had to be discarded to make room for the torpedo. In spite of every effort to make them light, the first torpedo-carrying machines seemed rather to hang in the air than to fly, and only extraordinarily skilled pilots were able to attack under such conditions.'

'After the first tests had been carried out at the front, it became clear that the chances of such an attack being successful were not nearly as good as at first one had been inclined to believe. Many ineffectual flights were made, and in most cases the torpedo was brought back to land. From this we learnt that the aeroplane had been made too light, but when all the corners and angles were strengthened, the weight of the machine increased. The appearance of more powerful engines, the 200 h.p. Benz and the 260 h.p. Mercedes, required a stronger and safer machine, but only improved the flying qualities to a slight degree, so that, even for the most up-to-date type, very skilful pilots, highly trained torpedo men, and a long course of training were necessary.'

<sup>1</sup> *Die deutschen Luftstreitkräfte im Weltkriege*, pp. 70-1. (English edition.)

One German officer<sup>1</sup> who was connected closely with the development of German torpedo-carrying aircraft has contributed the following notes on the subject:

'In 1916, the first experiments were made in the Baltic to release ordinary torpedoes against ships from suitable aircraft. After these experiments had been, to a certain extent, successful (in the eastern Baltic the Russian warship *Slava* was torpedoed) a separate seaplane Command was formed at Flensburg Creek, the base for the torpedo-plane flights for Zeebrugge and the eastern Baltic.

'From the seaplane stations on the North Sea and the Baltic the older and more experienced pilots were transferred to these flights, and they then had to undergo special training, dealing with torpedoes and their releasing, the course lasting at first only about two months.

'The Torpedo-Plane Flight No. 2, intended for Zeebrugge, was sent to Zeebrugge in March and at once became active. The flight was equipped with 5 twin-engined torpedo-carriers of the Gotha type, the engines were the 160 b.h.p. Mercedes. These machines behaved well in the air and in calm water (in the lee of the Mole at Zeebrugge) they took off very well. In a rough sea they could only start and alight at great risk, owing to their light construction. They were obliged to be of very light construction because the loads to be carried were very heavy.

'The machines were equipped with Whitehead torpedoes; the crew consisted of the pilot, the observer, the torpedo-gunner, and a machine-gunner for the back seat, who, however, in most cases was not taken because of the overloading of the machine. A special sight had been constructed by the firm of Pintsch, and this proved very satisfactory. The torpedo-releasing gear was also entirely satisfactory.

'The value of the torpedo-carrier flight in Flanders was greatly diminished by the fact that the Whitehead torpedoes were of too delicate a construction and were not equal to the demands made upon them when released from a machine; when the sea was rough, and in attacks made in a side wind, they mostly went to the bottom on account of the gyroscope refusing to work. At the firing practice in the Flensburg Creek, German torpedoes C. 45 with A.V. were employed, which were considerably heavier and always functioned perfectly. Unfortunately, the torpedo-carrier flight intended for active service could not be armed with these torpedoes, as there were only six of this type left, and for various reasons no new torpedoes of this model could be, or were, built.

'Attacks were almost always undertaken in misty weather, and when clouds were low, and mostly only by two machines, which, flying in the lower cloud layer, surprised and attacked English merchant steamers, in the absence of suitable warship objectives, between Dover and Yarmouth. The machines had to go down to a height of from 5 to 10 metres (16·5 to 33 feet) above the water and to a distance of less than 600 metres (650 yards) if

<sup>1</sup> Oberleutnant H. Becker.

possible. As the merchant steamers were protected against "U" boats by their own guns and generally escorted by patrol boats, the English defence was always very vigorous, unless the attack was an absolute surprise. The successes of the torpedo-carriers might have been considerably greater if the seaplane station at Zeebrugge had possessed enough fighters to protect them from being fired at by merchant ships and patrol boats. As these usually had their anti-aircraft guns quite unprotected on the deck, it would have been easy to prevent these ships from manning their anti-aircraft guns, if the fighters had swept the gunners with machine-gun fire from a low height. In one case, the writer prevented, by machine-gun fire, the guns of an unescorted steamer from being manned, so that the accompanying torpedo-carrier was able to torpedo the steamer at close quarters without any defence being made.'

The first attack on our shipping made by the Zeebrugge Torpedo-Plane Flight took place on November 9, 1916, when a steamer was sunk off the mouth of the Thames. Although the flight made many attempts to torpedo our shipping:

'in the last year of the War the torpedo-carrying machines were abandoned, for the results achieved did not justify the loss of men and material. After the first two torpedo attacks in Flanders and in the Gulf of Riga, the enemy's counter-measures became so effective that very little chance of success remained. The experience we had gained, at any rate, inasmuch as it applied to the design of the aeroplane itself, proved useful in the construction of long-distance reconnaissance machines with several engines.'

Had the enemy but fully realized it they had, in this weapon, one that, properly used, could have inflicted enormous damage to our shipping. Luckily, want of faith by their High Command and internal dissension prevented its use for this purpose being developed.

THE ACTIVITIES OF GREAT YARMOUTH AIR  
STATION DURING THE YEAR 1917

DURING the first three months of 1917 continued bad weather prevented flying to any great extent at Great Yarmouth air station.

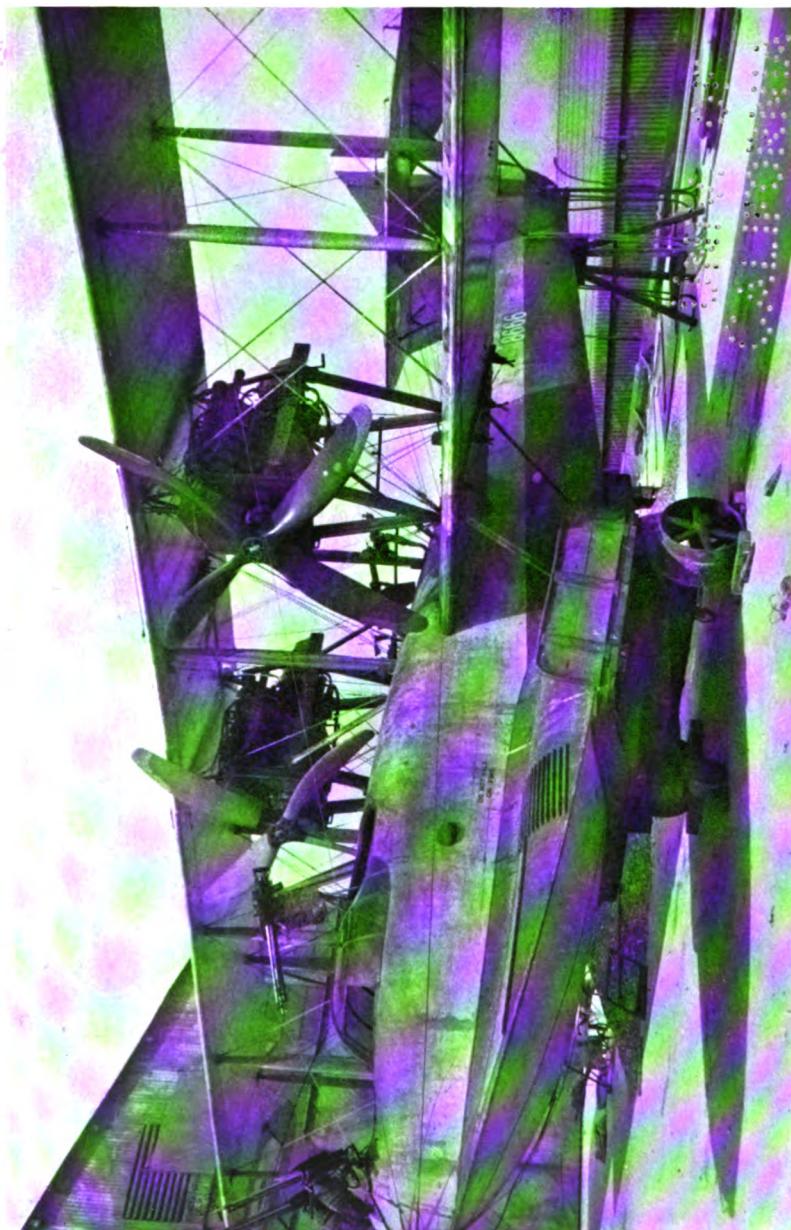
On March 2 two officers were killed—Flight Lieutenant E. L. Pulling, D.S.O., and Flight Sub-Lieutenant J. C. Northrop. This accident resulted from a crash which was caused by the collapse of the B.E. 2c in which these officers were flying when at the top of a loop. The wreckage of the machine burst into flames as soon as it struck the ground. Both Pulling and Northrop were brave men and their loss was felt deeply.

Some idea of the work done on the station during March may be gathered, perhaps, from part of the 'Daily Report' which is typical:

- '5.0 a.m. Seaplane 8378 (Short) Flight Sub-Lieutenant Fetherston left on patrol to Smith's Knoll and Haisborough light vessel area. Returned with nothing to report 10.30 a.m.
- 10.50 a.m. Seaplane 8066 (Short) Flight Lieutenant Livock, passenger A/M. Gibbs, left on W/T hostile submarine patrol to Smith's Knoll, Haisborough light vessel, Jim Howe buoy, and War Channel. Returned at 3.0 p.m. Nothing to report.
- 11.55 a.m. Seaplane 8370 (Short) Flight Lieutenant Murray left on patrol to Smith's Knoll and Haisborough light vessel. Returned at 12.45 p.m. with engine trouble.
- 1.30 p.m. Seaplane 8105 (Short) Flight Sub-Lieutenant Wild left on submarine patrol to Smith's Knoll, Haisborough light vessel, War Channel, and Southwold. Returned at 4.35 p.m. Nothing to report.'

It will be seen that the length of the patrols gradually became extended. It was found that the stress of flying over the sea for 4 and 5 hours at a time brought about a considerable strain on pilots, especially as they knew that in the event of engine trouble the chances of their being saved were remote unless they were able to land in the War Channel.

In April an event of some importance to the station occurred, for on the 13th Flight Sub-Lieutenant Leckie flew a flying-boat—an H. 12, N. 8660—from Felixstowe to Great Yarmouth; she was not, however, flown on patrol from the air station until May 1.



‘EIGHTY-SIX-SIXTY-SIX’



On May 5 another H. 12, N. 8666, arrived, having been flown from Felixstowe air station by Flight Sub-Lieutenants Leckie and Boswell with Air Mechanic Rolls aboard. This machine was, in its time, to earn the title of 'the most famous flying-boat in the Service'—and she started her career of fame exactly 9 days after she arrived at the station.

On the morning of the 14th, at 3.30 a.m., in thick weather, H. 12, N. 8666, left the station with Flight Lieutenant Galpin (in command and navigating), Flight Sub-Lieutenant Leckie (pilot), Chief Petty Officer V. F. Whatling (wireless telegraphic observer), and Air Mechanic O. R. Laycock (engineer). The flying-boat was armed with 3 Lewis guns and carried trays of Brock, Pomeroy, and Buckingham ammunition and four 100-lb. bombs, in addition to the wireless telegraphic apparatus. On leaving the air station the flying-boat was steered on a course for the Terschelling light vessel, Leckie piloting. At 4.15 a.m. Galpin relieved him, and when at a distance of 80 miles from Great Yarmouth 8666 ceased 'W/T communication to avoid discovery'. Thirty-three minutes later they sighted 'a Zeppelin dead ahead about 10-15 miles away and end on'. At the time the flying-boat was cruising at a speed of 60 knots at a height of 6,000 feet—the airship appeared to be 3,000 feet lower than 8666.

What happened afterwards is better told in Galpin's own words:

'We dropped 3 of the bombs to lighten ship at 5.0 a.m., and Flight Sub-Lieutenant Leckie took over the wheel again. C.P.O. Whatling went aft to the rear gun and I went forward to the 2 Lewis guns mounted parallel in the bow. The Zeppelin turned north and then north-east exposing her broadside, and I conclude she was coming south-west when we first saw her, and had now reached the limit of her patrol. We were then about 2 miles astern of her so increased speed to 75 knots, descending to 5,000 feet. She seemed as yet unaware of us, probably owing to our background of dark fog and cloud; but when we came within half a mile of her she put her nose up and seemed to increase speed. We dived at her at 90 knots coming up slightly astern at 3,800 feet, where we levelled out to 75 knots. In this position we overhauled her on the starboard quarter about 20 feet below the level of the gondolas. I opened fire with both guns at 50 yards range and observed incendiary bullets entering the envelope on the starboard quarter slightly below the middle. After a few rounds the port gun jambed, but the starboard gun fired nearly a complete tray before jamming also. We were then 100 feet from her and turned hard-a-starboard while I tried to clear the starboard gun. As we began to turn I thought I saw a slight glow inside the envelope and 15 seconds later when she came in sight on our other

side she was hanging tail down at an angle of 45 degrees with the lower half of her envelope thoroughly alight. Five or six seconds later the whole ship was a glowing mass and she fell vertically by the tail. C.P.O. Whatling, observing from the other hatch, saw the number *L. 22* painted under the nose before it was consumed. We also saw two of the crew jump out, one from the after-gun position on the top of the tail fin and one from the after gondola. They had no parachutes. When the airship had fallen to about 1,000 feet four large columns of water went up below in quick succession either from bombs or engines becoming detached from the framework. After 45 seconds from first ignition the envelope was burnt off and the bare skeleton plunged into the sea, leaving a mass of black ash on the surface from which a column of brown smoke about 1,500 feet high sprang up and stood.'

The action took place at 5.15 a.m. in longitude  $4^{\circ} 35'$  E., latitude  $53^{\circ} 25'$  N., that is, about 18 miles to the north-north-west of Texel Island.

Galpin did not see the number of his adversary, but as she was falling in flames Chief Petty Officer Whatling—who had seen it—scribbled the number on a signal pad and pushed it into the hands of the former, for the noise of the engines prevented speech. Galpin further reported:

'It was evident that we had 20–25 knots greater speed than she, even though we did not open our engines right out during the whole attack. This, combined with the complete surprise, gave us an incalculable advantage. The enemy appears to have attempted to return our fire as we have a bullet hole in the upper left plane and another in hull amidships. I consider she was set alight before he fully realized the nature of the attack; but even under normal conditions this type of seaplane should prove superior in every way to a Zeppelin if one can judge from the large amount of power which we left untouched. She was also very handy and easily conned from the forward cockpit by signals to the pilot. She proved an exceptionally steady gun-platform.'

So ended the career of *L. 22*. She was commissioned on March 3, 1916, and, according to German accounts, had taken part in 8 raids on this country and 41 'war cruises'; and from the same source it appears that on the morning of her destruction 'she was looking for mines off Terschelling'.

After the attack Galpin set a course, at 5.20 a.m., for Great Yarmouth and resumed wireless telegraphic communication when 80 miles from our coast. The return journey was made in practically continuous and heavy rain.

Thus, to Great Yarmouth air station fell the distinction of having destroyed the first enemy airship by the aid of a flying-boat.

Transmit no further  
messages until further orders.  
Is this correct?

L 22

Do you think he ever said  
us

Messages passed by Chief Petty Officer V. F. Whatling to Flight Lieutenant  
C. J. Galpin before and after the action with *L. 22*, May 14, 1917.



This action marked the beginning of our offensive against Zeppelin airships, and was the first attack of this kind made in the enemy's own waters. His airships were never again permitted to patrol the Bight of Helgoland at low altitudes, and, although subsequent attacks did not always bring positive results, they forced the airship commanders to remain at altitudes upwards of 10,000 feet, at which height these patrols were abortive against our submarines, and were also useless for the detection of mines.

The German naval authorities were not aware that *L. 22* was destroyed with the aid of a flying-boat (and we did not disclose the fact), as the following excerpt from the log of the High Sea Fleet will show:

'May 14.—Wind E. to NNE., force 3. For protective scouting *L. 22* goes up to the west; *L. 23* to the north. Mine-sweeping according to plan. Scouting Division II goes for protection of operations in the west to the Osterems. Thunderstorm 6.0 p.m. The Staff of the Fleet embarks in H.M.S. *Baden*. High Sea Fleet warships clear. Scouting Division II with two torpedo-boat leaders assemble in the course of the evening in Schillig Roads, for the intended manœuvres in the Bight on May 15. No communication from *L. 22* since report that she had risen. Thunderstorms in the west. It is possible that she has taken in her wireless mast and can send no message. In the late afternoon thick fog over the whole Bight, consequently not possible to have search made by seaplanes or surface craft. Seaplane No. 859 noted an explosion and a cloud of smoke at 9.50 a.m.'

'7.40 p.m.—The leader of the airships reports that according to telephonic information from Borkum this observation is very probably connected with the loss of *L. 22*. A telegram arriving at night from the Admiralty confirms this statement. The probability is that on account of the thunderstorm *L. 22* had to remain below the level where the gas would completely fill the cells, and was shot down by British warships.'<sup>1</sup>

Arising out of this action, on June 23 His Majesty the King appointed Flight Lieutenant C. J. Galpin a Companion of the Most Honourable Distinguished Service Order and awarded Flight Sub-Lieutenant R. Leckie the Distinguished Service Cross, and Chief Petty Officer V. F. Whatling and Air Mechanic O. R. Laycock the Distinguished Service Medal.

On May 20 the enemy made an attack with torpedo-carrying seaplanes on merchant shipping off the east coast. In the morning two German seaplanes attacked the S.S. *Birchgrove* (of Glasgow) near the Corton Channel buoy, just off Lowestoft. Each of these seaplanes launched a torpedo at the *Birchgrove* and fired about

<sup>1</sup> *Germany's High Sea Fleet in the World War*, pp. 283-4.

100 rounds of ammunition from their machine-guns. The pilots launched their torpedoes when their machines were about 12 feet from the sea and when they were, in one case, at a distance from the ship of approximately 1,000 yards and 200 yards in the other. The torpedoes failed to hit the *Birchgrove*, one missing her stern by about 10 feet and the other passing under the hull without impact. Immediately after this attack the enemy machines put about and evaded patrols from Great Yarmouth and Felixstowe air stations.

On May 24 the third Zeppelin airship raid of the year was made. The first of the two previous raids on February 17 had been made over Deal and Kingsdown, when no bombs were dropped on land. The second raid on March 16/17 was made over Kent and Sussex. We suffered no casualties as a result of these raids, but one of the raiding airships—*L. 39*—was shot down in flames by anti-aircraft gun-fire over Compiègne, France, and *L. 35* is understood to have reached Dresden in a crippled condition.

The raid of May 24 was made by 6 naval airships, but only one of them—*L. 42*—(Kapitänleutnant Dietrich) succeeded in approaching anywhere near London, for after having crossed the coast at Walton-on-Naze at midnight, he reached Braintree and then turned about to the north, crossing the coast at Cromer. He narrowly missed being engaged by Flight Lieutenants Cadbury and Walker and by pilots from No. 51 Squadron, R.F.C., from Thetford. The other airships cruised about the coast of Norfolk and Suffolk, where they dropped 2 tons of bombs on land, killing one man and damaging some farm property. Like our attacking machines, the enemy were hampered greatly in their operations by the fog and mist.

Flight Lieutenant Cadbury, in a letter written shortly after this raid, gives an insight into the conditions that night, stating:

‘About midnight, the airships were reported as closing in on the coast, so that all sub-stations were ordered up. The C.O. would not let me go up from here, but ordered up a pilot from Burgh Castle. He rang through later to the effect that the weather was too bad there, so was told to stand by. As Zeppelins were reported very close to, I asked permission to go up from here. . . . The C.O. eventually sent me off, and, owing to a mistake about the lights, I had a shaky get off.

‘At Yarmouth we do not show any lights at all in case we should attract Zeppelins to bomb the town, so in order to give us a line at night to get off by, a man is stationed at the far end of the Denes with a small shaded hand-lamp. This he lights just as the machine starts up, as otherwise the pilot

has nothing to keep his machine straight on getting off. . . . the lamp was never switched on and I had a very pleasant minute or so wondering which I was going to hit—the wireless masts or the monitor's<sup>1</sup> fire-control top.

'It poured with rain and blew very hard practically the whole time I was up. I climbed to 7,000 feet and was still in it, so, after being up for over an hour, I came down and landed at Burgh Castle. I got some terrific bumps as I was coming in to land, and as the night was as black as your hat, these were anything but pleasant.

'We nearly had a fatal accident landing. When I was about 50 feet from the ground, I happened to look round, just to have a look at my tail, when I saw, only a few yards behind me, the headlights of another machine coming in to land at the same moment! My lights were not working, and it was too late to do anything but land. So I opened out my engine slightly and pressed the button operating my "Holt Flares". . . . They worked and Walker saw them just in time and landed a few yards behind me and we both ran along together. It appears that those on the ground had heard us circling round one another, but owing to the rain and darkness I could not see his lights and mine were not working.

'We had been down about half an hour, when a message came through from Yarmouth that a Zeppelin was right overhead. I hopped into my machine and got straight off, missing known, but invisible, objects by unknown distances. Again, owing to cloud and rain, nothing was visible, so, after patrolling for an hour at 7,000 feet, I landed in the dark at Yarmouth. It was just beginning to get light, and so I could discern the line of the sheds and landed by them.

'At dawn we got a message that a Zeppelin was over Norwich, steering for Yarmouth. We thought we had got a sitter. I jumped into my little scout and crashed into the air. I examined all the clouds up to 15,000 feet, but could find no Zeppelin. It apparently got cold feet and went out over the Wash. We lost one pilot, a Sub-Lieutenant called Smith. He was stationed at Holt. He was seen chasing a Zeppelin and gave his life. The coast at Holt runs practically east and west. Thus, a strong south-west wind would blow him right out to sea. At 7,000 feet I could hardly make any headway against it. Thus, he evidently chased it right out to sea and was unable to get back.'

This raid started approximately at midnight on May 23, and early the next morning a flying-boat was sent from the air station to Terschelling Island in the hope that it might be able to attack the retiring airships. Moreover, it might be able to find out whether or not German surface craft had left their bases to support the airships in a 'combined operation'. So, at 3.15 a.m., the H. 12, N. 8666, carrying four 100-lb. bombs, left the Roads with Flight Lieutenant Galpin, D.S.O., in command and Flight Sub-

<sup>1</sup> H.M.S. *Roberts*.

Lieutenant Leckie, D.S.C., as the pilot, with Chief Petty Officer V. F. Whatling and Air Mechanic O. R. Laycock as the crew. An hour and a half later Terschelling Island was sighted. Thick clouds were met all the way, and the flying-boat climbed to a height of 7,200 feet without coming out of them, but later, at 3,000 feet, was clear of them. After sighting Terschelling Island, Leckie followed the Dutch coast for about 15 miles in an east-north-easterly direction until 5.20 a.m., when a position about 15 miles south-west of Borkum Riff light vessel was reached. As nothing was seen of the enemy's airships or fleet the flying-boat was turned on a west-south-westerly course, for Galpin decided to return to Great Yarmouth. Leckie now had to fly at a height of 1,200 feet owing to the low visibility.

At 5.38 a.m. a Zeppelin airship 'suddenly appeared out of the clouds at 2,000 feet', coming towards 8666 and distant about a mile. Thereafter, in Galpin's words:

'On seeing us he dropped two white flares; we did not answer this signal, but put on full speed, dropped our bombs and climbed up at him. He then turned quickly through 16 points and started to climb hard. When he reached 3,000 feet we had gained on him and were actually 300 yards astern. He threw out a smoke screen,<sup>1</sup> under cover of which he gained the main bank of clouds; it was not feasible for us to attempt to follow him there. As he disappeared I fired half a tray of Brock, Pomeroy, and tracer into him, but was unable to observe the effect.'

'I would point out that we were easily overhauling him on climb, and had the clouds been 1,000 feet higher, would undoubtedly have made certain of him.'

'We then climbed through open space until we reached the top of the cloud at 10,000 feet, the boat now being under light load, and continued west-south-west until 8.40 a.m., without sighting any more Zeppelins, when, no land being yet in sight and petrol very low, we descended near some trawlers to enquire our position. We found this to be Cromer Knoll, and we were taken in tow by H.M. Trawler *Carria*, who transferred us to H.M. Trawler *Rialto* which towed us towards Yarmouth. We were later transferred to *P. 25*<sup>2</sup> who brought us into Yarmouth.'

No account of this Zeppelin airship raid (May 23/24) would be complete without giving some details of the patrol made on the 24th by Flight Sub-Lieutenant H. M. Morris with his wireless telegraphic operator, Air Mechanic G. O. Wright, in a Short

<sup>1</sup> This is now known to have been water ballast.

<sup>2</sup> *P. 25* was one of the 'P' class of patrol boats, a form of fast craft, built to resemble at a distance a large German submarine travelling awash, and intended for hunting them.

seaplane from Westgate seaplane station. They were sent to look for another seaplane which had left previously to attack the enemy airships, and which had failed to return. After flying for some time and failing to sight the missing machine (which was later found and towed safely to the Isle of Grain), Morris put about and steered a course for Westgate because he was beginning to run short of petrol. Suddenly the engine of the machine stopped and he was forced to alight, and this he did in a big minefield 30 miles out to sea. This minefield started from an east and west line a short distance south of the North Hinder light vessel, and continued to a line running east above the North Foreland. On alighting the sea was calm and the weather fine, but they soon found that they could not repair the engine. As time went on the weather grew worse and seas started to break over the machine. The bombs were dropped and the petrol tank emptied to lighten the seaplane. The fumes of the floating petrol soon made both men violently sick. As night came on the seas grew steeper and finally smashed the machine to pieces, and Morris and Wright were left with one main float to which to cling. All the hand-hold that this gave them was two indentations which took the fittings for the undercarriage struts. All night long the two men clung to and knelt on this float, continually being washed by heavy seas. For a good part of the time Morris had to support Wright with one arm while he held on to the float with the other. Just before day-break they thought a trawler passed them, but though they shouted at the top of their voices she passed on—with the strong wind that was blowing those on deck could not hope to have heard them, even had they known the two men were there.

All next day Morris and Wright clung to their float, with no food but a few malted-milk tablets that Wright found in his pocket. To ease his thirst Morris took off his clothes and swam about (Wright could not swim), but after his legs and feet swelled so badly that he could not put his flying boots on again. By now the hands and legs of both men were badly lacerated and inflamed by sea-water.

During the afternoon of the 25th a number of German machines (which were returning from a bombing raid over Kent) passed at a low altitude over Morris and Wright. One of these machines circled over them, fired a Very light in their direction, and then flew on.

On the 26th and 27th the float was surrounded by thick fog—but still its occupants hung grimly on. The fog lifted on the

28th, the sun beat down on them, and they both became somewhat delirious—but withal steadfastly hung on to the float. They both survived the night of the 28th, and in the afternoon of the next day they were picked up (after five days' exposure) by a flying-boat from Felixstowe air station, piloted by Flight Commander Lindsay Gordon and Flight Lieutenant G. Hodgson. Gordon taxied his machine right up to the float and Morris and Wright were dragged aboard in an exhausted condition.

Their troubles were not yet over, for with the additional weight and because of the sea that was running the flying-boat could not leave the water, and so in bad weather Gordon taxied towards Felixstowe.

'Seas swept over the flying-boat. The hull, through continual pounding and crashing into the steep seas, started to leak badly, and the bilge pump was unable to cope with the rising water. As the wind-driven petrol pumps would only work when the machine was flying, one air mechanic had to pump the petrol into the 'ready-use' tanks by hand in order to prevent the engines from stopping and the boat 'broaching to'. Water leaked so badly into the hull that the tail became full, despite bailing, but fortunately the aft bulkhead held. Labouring badly, all held on stubbornly with their task. Meanwhile, Morris and Wright were lying in a semi-conscious condition in the bottom of the machine.'

Four hours after he had picked them up Gordon passed out of the fog belt and saw the Shipwash light vessel pitching and rolling in the heavy seas 3 miles to the north of him. He was, therefore, only a mile out of his course—no mean feat of seamanship when it is considered that he had taxied in a leaking boat for 22 miles against a head sea and a strong wind.

As soon as they saw the Shipwash light vessel the crew of the flying-boat fired Véry lights, and shortly afterwards the cargo boat *Orient* of Leith (bound for Great Yarmouth) came alongside, passed a line, and took them in tow. Half an hour later, when they were under the lee of the land, two armed drifters came alongside. The tow was transferred from the *Orient* to H.M.S. *Maratina*, and the rescued men were taken on board H.M.S. *White Lilac* in order to get them ashore for medical attention; but before they could be attended they were given too much food and were violently ill as a result.

The flying-boat was brought safely into Felixstowe harbour and made many patrols after this incident.

Both Flight Sub-Lieutenant H. M. Morris and Air Mechanic

G. O. Wright recovered (though to this day the former's legs and knees are terribly scarred), and within two months both were flying again. For the gallantry and endurance they had displayed in this affair His Majesty the King awarded the former the Distinguished Service Cross and the latter the Distinguished Service Medal.<sup>1</sup> The officers and crew of the flying-boat who rescued them received the Albert Medal.

Although considerable prominence has been given to the special activities of the flying-boats at the air station, it must not be thought that the ordinary work of patrols by seaplanes and land machines had not been carried on during March, April, and May. Whenever the weather permitted all routine patrols were made, and although the usual message at the end of them was 'Nothing to report', this apparently negative information was positive in its value, as it all helped with the general scheme of naval intelligence.

It may be remembered that the German Admiralty had decided that the naval Zeppelin airships should concentrate mainly on the work of reconnaissance, and in the opening days of June two such airships engaged in this work were brought to action by machines from the air station.

At 6.15 a.m. on June 5 Flight Lieutenant Galpin left in command of the H. 12, N. 8666, with Flight Sub-Lieutenant Leckie piloting. Leading Mechanic Thompson was the wireless telegraphic observer and Air Mechanic Ashby the engineer. This time 8666 carried no bombs, but, instead, 6 Lewis guns on twin mountings, and, in addition, 40 extra gallons of petrol. At the time Great Yarmouth was left there was a slight haze up to 6,000 feet, which increased in density as the Dutch coast was approached. A course was steered for Terschelling light vessel, the flying-boat climbing to about 6,000 feet. At 8.0 a.m. a Zeppelin airship was sighted about 10 miles to the north-east of the light vessel. In Galpin's words:

'Cruising at 2,000 feet about 6 miles to the north-east of us. We came down to 4,000 feet, but lost sight of her in the mist, and when next seen at 8.10 a.m. she was east-by-north and level with us at 4,000 feet. She then fired one white light which we answered with one white Véry light. We pursued her until 8.45 a.m., during which she climbed to 10,500 feet and were then immediately under her. At 8.25 a.m. we opened fire at 600 yards with the two guns forward and two amidships, and continued firing at

<sup>1</sup> Their act is also perpetuated by a painting in the Imperial War Museum entitled 'Almost a Resurrection', showing the flying-boat on the point of taxi-ing up to the float.

intervals until 8.45 a.m. Ten trays of Brock, Pomeroy, and Buckingham ammunition were fired, the closest range attained being 1,000 feet.

'There is no doubt that some of the shots took effect, but the tracer ammunition had burnt itself out before it reached the target. At 8.45 a.m. we had reached  $53^{\circ} 45' N.$ ,  $6^{\circ} 20' E.$ ,<sup>1</sup> and I decided it was impossible to continue the flight with any prospect of success as anti-Zeppelin ammunition had run short and with the westerly wind we had barely enough fuel to reach Yarmouth. We then turned about and set a course for Yarmouth, coming down to 2,000 feet to meet as little wind as possible. As soon as we turned the Zeppelin turned also, following us at a height of about 10,000 feet. At 9.17 a.m. we passed on the port hand 7 enemy destroyers steering east-by-north in  $53^{\circ} 34' N.$ ,  $5^{\circ} 11' E.$ ,<sup>2</sup> their formation being two divisions in line abreast. Enemy at once opened fire on us, two shots only of which were observed, both falling short.'

The officers and crew of 8666 alighted at Great Yarmouth at 11.20 a.m., after a patrol of over 5 hours, with petrol for another three-quarters of an hour's flight.

Nine days later (June 14) a similar adventure was met, and the Zeppelin airship sighted was fortunate enough again to escape destruction. At 7.5 a.m. that morning H. 12, N. 8660, left the air station with Flight Lieutenant Galpin in command and Flight Sub-Lieutenant Leckie piloting. Leading Mechanic Thompson and Air Mechanic Grant were the crew. The orders were 'to search the area 25 miles east of Southwold for hostile aircraft indicated by enemy W/T signals'. After steering east for 15 miles, a south-south-easterly course was laid, the flying-boat climbing as rapidly as it could. At 8.8 a.m. the North Hinder light vessel was passed at a height of 9,500 feet, and Galpin and Leckie 'having seen nothing began to return northward'.

Seven minutes later, about 15 miles to the east of them, a Zeppelin airship was sighted, 'steering westward at a height of 10,500 feet'. Now, in Galpin's words:

'Leckie turned 8660 to meet her, climbing hard. She saw us 10 minutes later, threw out her water ballast and went up to 15,000 feet, at the same time turning north-north-east and making off. By 8.45 a.m. we had reached a height of 12,500 feet immediately under the Zeppelin, and fired four trays of Brock, Pomeroy, and Buckingham into her. I observed the bursts of tracer going well on to the target, but the incendiary must have burnt out by the time it reached her; it is quite possible she was hit by explosive bullets, but no immediate result took place; four tracers were seen to be fired at us.'

<sup>1</sup> That is, they were about 18 miles to the north-west of Borkum seaplane station.

<sup>2</sup> Just off Terschelling Island.

'At 9.15 a.m., after we had manoeuvred without effect for another half an hour endeavouring to get up to her, as she showed no signs of coming down, I decided to break off the fight without wasting further fuel and ammunition. We steered south-west-by-west for an hour and ten minutes, landing at Yarmouth at 10.24 a.m. From a comparison of times I conclude we left the Zeppelin approximately  $53^{\circ}$  N.,  $4^{\circ}$  E.; she was then steering north-east at 15,000 feet.'

They had, therefore, chased her to within about 15 miles of the Haaks light vessel. The airship was *L. 46*, although Galpin thought she was *L. 48*, but, as he was careful to state at the time, 'with regard to the accuracy of the number, I would point out that it was observed through binoculars from underneath, and on account of the vibration it was very difficult to make certain whether the last figure was 3, 6, 8, or 9'.

The observation officer of this airship was Oberleutnant Richard Frey, and after the War he published an account of this action in which he said:

'Early in February 1917 we again made a series of scouting trips on the North Sea in our *L. 22*. On February 9 we handed our ship over to a new crew and were given four weeks' leave. When our leave was over, we were ordered to the airship works at Friedrichshafen, and there saw the building of *L. 46*. . . . The first part of our stay there was occupied in working on our ship, and also in making short practice flights, so that both officers and crew should become fully accustomed to the ship. Owing to the greatly increased useful load—39,000 kg. (40 tons)—we could reach altitudes we had never risen to before. In order that the crew might be capable of working in the very rarified air at these heights, means had to be provided for artificial respiration. For this purpose we carried for each man a small bottle containing compressed oxygen, from which the men could breathe when required.'

'It was on May 5 that our first high flight was to take place, in order to test both the ship and the crew at high altitudes. We had the most modern ship on the station and were naturally anxious to obtain results that no other ship had obtained hitherto. We ascended every night, as these flights were also to be utilized for protecting our bases at Cuxhaven and Bremerhaven. As the last raids on England had shown that the light colour of the envelope was very disadvantageous, because it reflected too much light from the searchlights, the body of the ship had been painted black from underneath to beyond the middle line. The cars were also absolutely black. We could notice at once the success of this measure during these night flights, because the searchlights could not find the ship, even at a relatively low altitude, as the light was absorbed by the black paint. We unfortunately had to recognize, however, that our coast defence searchlights were very miserable, as compared to the English ones. The cone of light of our searchlights

could reach, at most, a height of only 4,000 metres (13,000 feet). It is lucky for us that we never had an enemy air raid on our coast!

'We were extremely pleased with the result of our flight at high altitudes. Although we had temperatures relatively unfavourable, we had nevertheless reached 6,100 metres (20,000 feet), when we still had a useful load of 7,600 kg. (7 tons) on board. The performance of the crew had also been very good. We were about 5 hours at high altitudes above 4,000 metres (13,000 feet) without any inconvenience having been felt by the officers and crew.

'As *L. 46* had stood her trials so well, we were already ordered to go scouting over the North Sea on May 7. There also the conditions had altered much in the meantime. It had repeatedly happened that airships had been attacked by English aeroplane squadrons during their scouting trips. *Consequently these flights had now to be done at altitudes exceeding 4,000 metres (13,000 feet) in order to have an adequate view and be safe to some extent against surprise attacks.* Of course, this again meant a greater strain on the crew, because at these altitudes, even during the summer, temperatures below zero prevailed, in addition to which flying in rarified air was a strain in itself. As the aeroplanes were often difficult to recognize, the greatest vigilance was required from every man during the entire flight. . . .

'Our first fight with *L. 46* was to be experienced with unexpected rapidity. In the afternoon of June 13 we were advised by the F.d.L.<sup>1</sup> that we should be ready for a long-distance scouting flight for the same night. A push was to be made in the region of the headlands, to observe the commercial traffic. The start would take place at night, so that the ship should not be seen beforehand by seaplanes who could warn the English. During the day we were to remain concealed in the blockaded area and commence our scouting work.

'We ascended at 11.15 p.m., on June 13, and proceeded without interference over the North Sea towards the west. On the morning of the 14th, we could see nothing particular about the blockaded area, except a few neutral steamers and sailing ships. All at once, about noon, we sighted aft a large English seaplane (Curtiss boat type) coming on very fast. The pilot had behind him quite a light screen of clouds, much broken up and lying at an altitude of about 3,000 metres (10,000 feet), and of which he had made a clever use to conceal himself from us. He had thus succeeded in coming fairly close to our ship. It was all-important in the first place *not to allow the machine to come over the ship*, because if the pilot managed to reach that position, he could hardly miss our target 200 metres (656 feet) long and 25 metres (82 feet) in diameter. Fortunately, we had discovered the flying-boat in time, and we could rise above it without difficulty. . . . The flying-boat was closing in very rapidly. We could see now its two occupants distinctly, who seemed to be already sure of their booty. We inclined our ship

<sup>1</sup> *Führer der Luftflotte*—the Commander of the airship Service—Korvettenkapitän Strasser.

to an angle of about 20 degrees, and then shot upwards with the rapidity of an arrow. The flying-boat pilot opened fire with his machine-gun, but shot very badly as he himself was climbing. The heavy flying-boat could only remain at an altitude of about 4,000 metres (13,000 feet) at somewhat of an angle. We, on the contrary, had risen in a few minutes from 4,000 to 5,000 metres (13,000 to 18,000 feet), and then attacked the flying-boat with the machine-gun in our forward car.

'In the heat of the fight we had not even felt the enormous difference of air pressure we had gone through so quickly. Although breathing was somewhat shorter, no one had yet thought of artificial aids to easy breathing, and every one was entirely bent on repelling the attack. When we had risen to about 1,500 metres (5,000 feet) above the flying-boat, she could be no longer dangerous to us. Our crew immediately recovered their good spirits, and we then took photographs of the machine.<sup>1</sup> We then reported the fight by wireless to the fleet commander. Meanwhile we continued a lively fire on the flying-boat, which would *not* give up the pursuit. After about one hour, her pilot finally saw the hopelessness of his efforts, and he turned round and flew home.

'As the fight took place at noon, we had unfavourable temperatures and consequently had to release a great deal of water ballast, besides raising the ship dynamically to reach 5,500 metres (18,000 feet). It may be of interest to know that a ship of the size of *L. 46* carried about 26,000 kg. (28 tons) of water ballast. As already stated at the beginning of this account, the ship throws off gas while rising and thus loses some of its carrying capacity. This loss must be compensated by throwing water away. A rise of 100 metres (328 feet) means a loss of carrying capacity of about 1 per cent., so in the case of our ship, it was about 640 kg. (1,400 lb.). Rain load also had to be reckoned with, which may go as far as 3,000 kg. (nearly 3 tons). We had therefore pretty well exhausted our water ballast, and so considered it advisable to turn back, as we must expect a considerable cooling of the gas in the evening, and this would have made our ship heavier still. But we wished to avoid at all costs that our ship should become damaged through heavy landing.'<sup>2</sup>

Another airship—*L. 43*—had not the same good fortune that day (June 14) as had *L. 46*, for the former was shot down in flames off Vlieland from a flying-boat, H. 12, *N. 8077*, belonging to Felixstowe air station. The pilot of 8077 was Flight Sub-Lieutenant B. D. Hobbs, and the gunner was Flight Sub-Lieutenant R. F. L. Dickey. According to German accounts it was believed (because of the report of *L. 46*) that *L. 43* was shot down by Galpin.

<sup>1</sup> Unfortunately the coxswain who took the photographs made a double exposure on the same plate.

<sup>2</sup> *Deutsche Zeitung*, May 22, 1927.

June saw another attack by German torpedo-seaplanes on merchant shipping, for on the afternoon of the 14th five such machines appeared about 15 miles to the south-east of Harwich. They attacked the Greek steamer *Antonios* about 5 miles from the Sunk light vessel. They achieved no success, for although they launched a torpedo at her, dropped bombs on her, and opened fire with their machine-guns, all these missiles failed to hit the *Antonios*. They then attacked another steamer, the *Canto*, with similar negative results, but they succeeded in sinking the steamer *Kankakee* about a mile from the Sunk buoy. So quickly did they make this attack that the gun-crew aboard the steamer did not have time to clear away the gun. All the 5 enemy machines succeeded in making good their escape, which was not so difficult as perhaps appears, for as one pilot from the air station remarked at the time:

'Unfortunately we are very short of Sopwith fighting scout pilots, which are the only machines of any use against seaplanes, as they can obtain considerable altitudes in a very short time. . . .

'The usual stunt of the Germans is to send out a squadron of torpedo-seaplanes, which attacks shipping at a point about 30 miles away. As we get very little warning till the enemy actually appears, fighting scouts have to go out on very slender information, which is nearly always incorrect.'

During June enemy airships were very active in the North Sea, and on June 16 Flight Lieutenant Bittles, while flying in a Sopwith Schneider seaplane, sighted a Zeppelin airship about 30 miles due east of Lowestoft. He climbed to a height of 11,000 feet and opened fire, and, so far as he could see, all the rounds from his Lewis gun hit the airship (and he emptied one tray of ammunition into her), but she failed to catch fire and after the attack quickly ascended an additional 4,000 feet. The seaplane was quite incapable of climbing to such heights rapidly, so her pilot broke off the action, and later returned to the air station.

The next 24 hours saw many anti-airship operations. On June 17 4 naval Zeppelin airships attempted to attack this country. Only two, however, actually crossed the coast—*L.42* and *L.48*. The former bombed Ramsgate at about 2.0 a.m., causing considerable damage, blowing up a naval ammunition store. She eluded our defences and made good her escape.

*L.48* was commanded by Kapitänleutnant Eichler and had aboard Korvettenkapitän Schütze, the commander of the 'North Sea Airship Division'. She crossed the coast at Orfordness at 2.0 a.m., and later dropped some bombs around Martlesham,

causing but little damage. She was then shelled by shore defences and by ships in Harwich harbour. Shortly afterwards she was attacked by Second Lieutenant L. P. Watkins (Canadian Army) of No. 37 Squadron, R.F.C., from Goldhanger aerodrome. Watkins was at a height of about 11,000 feet over Harwich when he 'saw the A.A. guns firing and several searchlights pointing towards the same spot'. Almost at once he sighted *L. 48* about 2,000 feet above him. He climbed immediately up towards her, firing two drums in succession into her tail without effect. Having now reached 13,200 feet, he was still some 500 feet below *L. 48*. Three short bursts were followed by the remainder of the drum, and 'the Zeppelin burst into flames at the tail'. Captain R. H. M. S. Saundby, of the Experimental Station at Orfordness, also had engaged her about the same time.

Flight Lieutenant Cadbury, who was flying in a Sopwith Pup, witnessed the attack from the air, and was of the opinion, at the time, that *L. 48* was hit by a shell from an anti-aircraft gun, but later her destruction was decided officially as having been caused by Second Lieutenant L. P. Watkins. In a letter written a few days after the raid Cadbury said:

'The C.O. and I were playing tennis on Saturday evening when Zeppelins were reported approaching the coast. Finishing our set, we went below and spent a night of listening. At about three-hour periods through the night there was a terrific explosion, which made everything jump about. However, airships were reported crossing the coast-line a long way south of here, but none came near here. It was a priceless night, and any Zeppelin that had shown itself would have been a sitter—such a change from the usual rotten nights we have had to fly in previously. Unfortunately we had to be contented with standing by our machines, for no game appeared.

'At 3.0 a.m. a Zeppelin was reported to be coming up from the south. As I knew it would be getting light in about half an hour, I got out my scout and went off in that. It was pretty rotten flying an unstable fast machine in the dark, and I realized how essential it was that a night machine should be "stable".

'I rose quickly to 11,000 feet and was over Lowestoft when I saw *L. 48* go down in flames, hit by a shell. . . . At the same time I saw 2 Zeppelins out about 20 miles to sea. I gave chase, climbing all the time. I chased one of them<sup>1</sup> for about 20 minutes at 15,500 feet, but could not catch up with it. It was at about 16,000 feet and still 15 miles away. The new Zeppelin must be very fast, as I was flying at about 80 to 90 miles an hour and could not catch him up. I was forced to give up the chase, for, when about 20 miles out, a petrol pipe fractured and started letting all my petrol out.

<sup>1</sup> *L. 42.*

However, by keeping my finger over the end of the broken pipe, I stemmed the flow a little, and just made the coast of Yarmouth, soaked in petrol. Not a very pleasant trip, as, if I had come down in the sea, my machine would have floated for about 10 minutes. . . . The burnt Zeppelin fell 11,000 feet into a cornfield; four men survived the crash—the Commander, who died later, the second in command, and one of the crew. The latter threw himself out and used his coat as a parachute, landing safely.'

Other officers from Great Yarmouth air station—Flight Lieutenant Fane and Flight Sub-Lieutenants Iron and Brenton—witnessed this attack from the air, and all of them vainly endeavoured to come within striking distance, but their machines could not reach a greater height than 12,500 feet—1,000 feet lower than the Zeppelin airship.

*L. 48* fell, a burning mass, into a field at Holly Tree Farm, near Theberton. She came down comparatively slowly, stern first, taking nearly 5 minutes to reach the ground. Kapitänleutnant Eichler was alive when picked up, but died almost immediately. Korvettenkapitän Schütze was burnt to death, but Oberleutnant Mieth survived (though terribly injured); so also did two ratings, one of whom was unhurt.

*L. 48* was a brand-new airship, having been commissioned on May 2. She was destroyed on her maiden raid.

Next morning (June 18), in accordance with the general practice, it was decided that some seaplanes should be sent off at day-break from the air station to try to intercept the returning airships before they reached Germany. The necessary preparations were not without humour, for one officer:

'choked his engine by giving it too much petrol, and was unable to start, so we tied a rope on to his tail, pushed him into the water, and towed him back on to the beach, out of the way while we got the other machines off. By dint of much winding of the hand-starting gear, he got rid of his excess petrol, and the engine started. This was followed by a cry for help from the two men who were on the other end of the rope, as the pilot was proceeding to fly away and take these fellows with him, having completely forgotten that there was a rope on his tail. More men went to the rescue and the pilot was held. In spite of this, however, he tried all the tricks he knew to get off. He rocked and slewed, pushed and pulled, and the engine roared, he got hot and the mechanics all got wet, but eventually the pilot switched off his engine, being quite convinced that some one had put his airscrew on "b-b-b-backwards!"'

Only one of the 3 machines succeeded in coming into action with the retiring enemy, and this was the H. 12, *N. 8666*. She

left Great Yarmouth at 3.5 a.m. with Flight Commander Nicholl in command, Flight Sub-Lieutenant Leckie piloting, and the crew were Leading Mechanic W. Fairnes and Air Mechanic A. Grant. They 'proceeded north 80° east gaining height as quickly as possible'. Thereafter, in Nicholl's words:

'At 3.40 a.m. (G.M.T.), I sighted a Zeppelin about 12 miles ahead at about 8,000 feet and immediately gave chase, climbing to 12,000 feet; the Zeppelin remained about 8,000-10,000 feet.'

'Pursued the Zeppelin for 1 hour 35 minutes, to a position about 10 miles north of Ameland, only gaining about 2 or 3 miles on the airship during this time.'

'On seeing that it would be impossible to overtake the airship I gave up the chase at 5.15 a.m. (G.M.T.); the Zeppelin was still 10 miles ahead of us; I altered course to 260° and returned to base at 7.50 a.m. (G.M.T.).

'On account of the altitude at which we were flying and the bad visibility, it was impossible to see if there were any enemy surface ships in this area.'

At this period, and until the Armistice, when an air raid was in progress it became the standard practice at the air station, firstly, to send all land machines up to attack the raiding airships; and, secondly, as soon as dawn broke, to send out seaplanes and flying-boats to try to intercept at sea the returning airships and any ships of the German fleet which might be at sea supporting the airships. The flying-boats made for Ameland, and some seaplanes steered a course for beyond the Smith's Knoll light vessel, while others made for the Haaks light vessel. By this means the area of retirement of the enemy was well covered.

During July a great deal of flying was done at the air station by all types of machines, especially on anti-submarine patrols. During the month 113 of such flights were made, in which 12,320 miles were covered—nearly double that of the previous month. From sunrise until sunset, and often later, machines were continually in the air, and the majority of pilots made several patrols during the day. The guiding and inspiring spirits behind this work were the Commanding Officer, Squadron Commander Oliver, and his First Lieutenant, Flight Commander Nicholl.

On July 12 an attempt was made to engage a Zeppelin airship north-east of Terschelling Island by Flight Sub-Lieutenant Leckie in the flying-boat N. 8660, but she could not come within striking distance of the airship. This was unfortunate, as a little later 20 enemy mine-sweepers were sighted off Ameland, but they could not be attacked as the bombs in 8660 had been dropped in the attempt to reach the airship.

On the 26th *L. 46* again had a narrow escape from destruction at the hands of Flight Commander Galpin and Flight Lieutenant Leckie. Before describing this particular action it may be stated that our system of Intelligence Reports, relating to the movements of enemy airships, gave accurate information, and in the majority of cases we usually knew what airships were on patrol in the North Sea at any given time, together with their patrol areas.

To return to the attack of the 26th, in view of certain reports of enemy airship activity, Flight Commander Galpin and Flight Lieutenant Leckie, together with Leading Mechanic Thompson and Air Mechanic Walker, left the air station at 7.22 a.m. in 'Old eighty-six-sixty-six', as she had come now to be known. At the time they left the Roads the weather was hazy, fog banks being encountered up to 6,000 feet, 'and the visibility was about 4 miles'. At first the sea was calm, but the wind freshened later and veered to the south-west. 8666 carried no bombs, and 'made Texel Island at 9.0 a.m., by which time we had climbed to 7,000 feet'. Then Galpin thought it advisable to strike the Dutch coast rather to the south, as they would then 'be between the sun and any Zeppelin', and thereafter they flew out to sea along the Dutch coast. The succeeding events may best be described in Galpin's words:

'At 9.10 a.m., we sighted a Zeppelin, which proved later to be the *L. 46*, about 15 miles north of us and proceeding northwards. We gave chase and got up to her about 9.35 a.m. We were both at about the same height, 10,000 feet, and the Zeppelin had turned westward, so that we were approaching her on her port beam. *L. 46* appeared to be unaware of our presence, probably owing to the sun behind us, until we came within a mile of her. She then suddenly threw out ballast, at the same time putting her nose up to an angle of 15 to 20 degrees, and her helm hard over. She did not stop climbing until she reached 14,000 feet, when she turned north-east and made off home. In this position we fired four trays of Brock, Pomeroy, and Buckingham at her from 11,500 feet, which was our maximum attainable height, but without apparent effect. She dropped two bombs at us when we were immediately below her, and also fired a machine-gun. Bullet holes were made in the top plane of the centre section, on either side of the gravity petrol tank and just missing the hull.'

'At 10.0 a.m., we observed another Zeppelin about 10 miles north of us at about 8,000 feet, and so broke off the useless attack on *L. 46*. We were within 3 miles of this Zeppelin when she also put her nose up, threw out ballast, and went up to 15,000 feet, turning eastwards. I conclude she received a signal by W/T from *L. 46*. At 10.23 we abandoned the chase

as both Zeppelins were beyond our reach; when last seen they were both going eastwards at 15,000 feet. We returned to Southwold at 1.45 p.m., and Yarmouth at 2.2 p.m.'

So rapidly did *L. 46* release her water ballast that, to the occupants of the flying-boat, it appeared like a curtain of mist through which the latter flew in her efforts to catch the airship. When she put 'her nose up to an angle of 15 to 20 degrees, and her helm hard over', the ensuing sight so amazed Leckie that he yelled involuntarily: 'Look, Galpin! My God! She's stalled!'—an unconscious tribute to the ascending powers of the airship, which were so great that Galpin has said since that to watch them rising gave one the feeling that one's own machine was falling through space at an alarming rate.

The commander of *L. 46* was Kapitänleutnant Hollender and his observation officer was Oberleutnant Richard Frey, and the latter subsequently recorded his impressions of this action, stating that:

'On July 26, *L. 46* was to experience her second fight. We were under orders to patrol to the west and ascended at 3.20 a.m. The weather was fine and visibility good, and during the whole of the morning we had seen nothing suspicious. Towards midday we discovered one of our own mine-sweeper flotillas at work. Since it seemed quite safe to our Commander, we went down to 3,000 metres (10,000 feet) in order to find out the position of the flotilla by heliograph. The weather had become somewhat thick, so we had only a relatively small field of sight. As we entered this region of visibility everything coming into sight became suddenly sharp and clear, although it had been completely invisible the moment before. "Seaplane to starboard!" came a yell from three throats all together. The Commander, the elevation steersman, and I had spotted him simultaneously. The shout had an electrifying effect on the whole crew. In the same instant came the Commander's orders: "Rise to 5,000 metres (16,500 feet). Hard-a-starboard!" It was another Curtiss boat with two pilots. The pilots had probably already seen us ere this and had succeeded in coming up unnoticed in the mist. The flying-boat was at the same height as ourselves and only 2,000 metres (2,200 yards) astern from us, so that it was a question of the utmost haste. We turned before the wind, in order to run before the flying-boat.

'Next, the ship rose at a very great speed to 3,500 metres (11,500 feet), but then turned head downwards and rose no further. Something must have gone wrong with the ballast arrangements. With the disengaged elevation steersman I went up into the gallery and we found that the wire of one of the water bags had broken, probably through being pulled too vigorously, and consequently the 1,000 kg. (2,200 lb.) of water had not run out. I ordered the bag to be emptied from the gallery and hurried back to the gondola.

'Now came the critical moments. The flying-boat had reached the same height as we, and was now only 1,000 metres (1,100 yards) astern. Round about the ship we saw the small shots detonating, one of which would have been sufficient to bring about the destruction of the ship. Hollender said to me: "I am only waiting for the report—'The ship is on fire.' " I can still see each single man in the gondola. There was not one who lost his head or was afraid, each one carried on with his duty down to the slightest detail, they would all have given their lives courageously for Emperor and country. . . . As for myself, there went through my mind in this moment of greatest danger the thought: "And this is how good old Kraushaar<sup>1</sup> must have died." Then at last the ship righted herself and rose up again, swift as an arrow; it looked almost as if it was the flying-boat falling headlong. We immediately opened a brisk machine-gun fire against our enemy and wirelessed to the fleet. Both these actions were actually risky during the swift ascent of the ship, since self-ignition might have occurred owing to the streaming out of the gas. But it had to be risked, otherwise the flying-boat might have destroyed us, and the Leader of the airships must know what had brought about the loss of his ship, so we let rip and all went well.

'The well-aimed machine-gun fire soon became unpleasant to the flying-boat and it suddenly turned round and flew homewards. We were saved, and from all eyes there flashed to me the thought: "The gift of our lives has been bestowed on us once more!" . . . The seaplane attack had been repulsed and we could continue our scouting unhindered. At 7.0 o'clock in the evening we made a good landing at Ahlhorn.'<sup>2</sup>

Weather conditions in August were unfavourable and considerably impeded flying operations generally, more especially during the opening weeks, and the number of miles flown at the air station on anti-submarine patrols dropped to 3,880, as compared with 12,320 miles for the previous month.

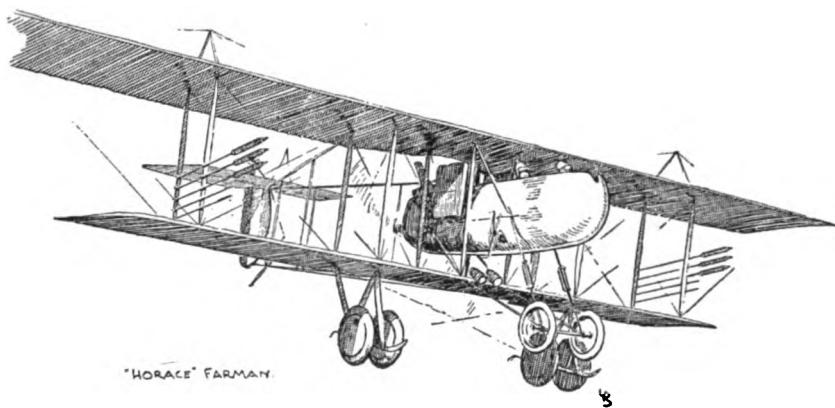
On the third anniversary of the declaration of war (August 4) the number of officers at the air station was 44. Between the January and August of this year the following officers joined the station: Flight Lieutenant L. C. Shoppee, D.S.C., Flight Sub-Lieutenants C. R. Rischbeith, E. G. F. Thompson, W. A. N. Davern, P. G. Shepherd, and J. W. Nixon. Three Royal Naval Volunteer Reserve 'specialist' officers also were posted to the station: Lieutenant A. E. Holder (motor-boats), H. E. Powell (engineer), and A. E. Hartley (intelligence). The last-named officer deserves mentioning especially for the work he did in collecting and corroborating reports of enemy activities. Before

<sup>1</sup> The Commander of *L. 43* which was shot down in flames June 14, 1917.

<sup>2</sup> Vide p. 152 of an article by Oberleutnant Richard Frey, entitled 'Erinnerungen an Ahlhorn', in *Zwei deutsche Luftschiffhäfen des Weltkrieges, Ahlhorn und Wildeshausen*.

his arrival, as one officer has since remarked, 'we had nobody whose particular "pidgin" it was to look after intelligence, and sometimes on the night of an airship raid one officer would be simply brimful of information as to the position of the Zeppelins, and then, because of the shortage of pilots, he would have to push off into the air, carrying all his precious knowledge with him—which didn't help things'. With Hartley's arrival the state of affairs improved rapidly.

Including the night landing-grounds there were 60 machines on



the station. This total was made up of 16 B.E. 2c's, 2 B.E.'s, 6 Bristol Bullets, 3 'Horace' Farmans, 6 Sopwith 1½-Strutters, 2 Sopwith Pups, 13 Sopwith Schneider seaplanes, 10 Short seaplanes, and 2 H. 12 Curtiss flying-boats. During this month the 'Yarmouth Striking Force' came into existence. This was composed of the 'Horace' Farmans, Pups, and 1½-Strutters. As one of 'The Force's' pilots later remarked, 'It was meant to attack hostile aeroplanes, but none ever came near, yet its adventures would fill books'.

On August 21 Flight Sub-Lieutenants Fetherston and Halford-Thompson were flying in the H. 12, N. 8660, 35 miles east of Smith's Knoll light vessel. At 12.35 p.m. a submarine was sighted on the surface about 5 miles from the light vessel, whereupon the flying-boat altered course and dived to attack. The crew on the deck of the submarine, however, sighted the machine, and the boat was 'crash-dived'. Four 100-lb. bombs were dropped from a height of 800 feet, straddling the position where the submarine had submerged, after which there were no further signs

of the enemy. It was learnt later, however, that the submarine was not destroyed as a result of this attack.

It will be admitted perhaps that exceptionally good use had been made already, by certain pilots, of the two H. 12 flying-boats at the station, and it will have been noticed also from the combat reports that, as a result of their efforts, Zeppelin airship commanders had discovered by this time the danger of patrolling at low altitudes, and so, to save themselves, increased the height at which their reconnaissance patrols were made. With this increase in height the value of these reconnaissances was diminished, for the North Sea is usually covered with a veil of low clouds, which of course hampered aerial operations at high altitudes. As Flight Commander Galpin remarked subsequently:

'It is a fact that *L. 22* was cruising at 2,000–3,000 feet, whereas after the first attacks we never found them anywhere as low as that, and I am convinced that we stopped them scouting for our *submarines*, which of course were very active in the Bight. Nothing over 3,000 feet would be any use for anti-submarine patrol. An undisturbed Zeppelin could cruise at 1,000 feet and spot any submarine breaking surface, even with her periscope; therefore we did a job of work.'

This officer's opinion, it may be remarked, is supported by the statement of Oberleutnant Frey when describing the attack of June 14 by the H. 12, *N. 8666*, on *L. 46*.

Again, as a result of our attacks, the airship commanders were kept on the constant look-out, and in the encounters which have been related recently they had been able to make good their escape by the narrowest of margins. Accordingly, we now had to devise new methods of bringing home a successful attack.

With the arrival of the first D.H. 4 land machine in August the air station had a fast, high-climbing, formidable fighting aeroplane, capable of an endurance of 6 or 7 hours. Although the feat of flying over 500 miles of sea in a land machine with no form of floats or flotation gear, with the certainty of a crash in the not unlikely event of engine failure, was an extremely hazardous operation, it was decided that the D.H. 4 was Great Yarmouth's most certain weapon at that time for anti-airship patrols.

To decrease as much as possible the risk to the aeroplane, the D.H. 4 was to be escorted by a flying-boat, the duty of whose crew was to try not only to effect a rescue of the occupants of the land machine in the case of a forced alighting, but also to relieve her pilot of the necessity of accurate navigation, which was diffi-

cult in such a craft. In the case of the D.H. 4 failing to shoot down the airship the flying-boat would, of course, then attack.

Before describing the subsequent operations made by the two D.H. 4 machines against Zeppelin airships, it may be of interest to tell the story of how they came to the air station.

In the early summer of 1917 the Admiralty wanted some aerial photographs taken of some of the German naval bases west of the Kiel Canal, and for this purpose it had two D.H. 4's (equipped with the Napier-built 200 b.h.p. Raf engine) fitted with especially large petrol tanks, so that the machines would have an endurance of about 14 hours; special cameras were fitted also into the machines. The personnel originally selected for this operation was—pilots: Squadron Commander the Master of Semphill and Flight Lieutenant F. S. Cotton; while the observers were Observer Lieutenants G. S. Trewin, D.S.C., and E. B. C. Betts. These officers were posted to Hendon air station about the middle of June and started flying practice with these machines. During August the Master of Semphill was posted to another unit, and his place was taken by Flight Lieutenant A. H. H. Gilligan.

On August 9 the two machines were flown up to Bacton night landing-ground, for it had been decided that the pilots should fly from there, across the North Sea, take their photographs, and, if all went well, land at Dunkerque. Bacton was selected as it was a large aerodrome and nearest of all to the German coast.

While the machines were at Hendon they had been camouflaged with a matt dope, sky blue and biscuit colour, with the result that they were very difficult to spot from the ground.

During the middle of August Flight Lieutenant Fane took Cotton's place, and about the same time the Admiralty decided that the machines should not go on the projected trip, but should be used for anti-airship operations in conjunction with flying-boats from Great Yarmouth air station.

As soon as this decision had been made Squadron Commander Oliver decided that it would be better if the D.H. 4's came to the air station rather than remain at Bacton, because it would be easier to arrange the necessary *liaison* with the flying-boats there than at the night landing-ground. The two machines were flown down, therefore, to the air station on August 26. After their arrival they were tested carefully in the air.

On September 5 (a Wednesday) information was received at the air station that some Zeppelin airships were operating off

Terschelling Island, and preparations were made at once to attack them. (On the previous afternoon Leckie, in the H. 12, N. 8666, accompanied by one of the D.H. 4's left the air station to attack a Zeppelin airship, but they were forced to return on account of fog.) Flight Lieutenants Fane and Betts, who were living at the air station and 'therefore on the spot, got into one 'bus and had the engine running when Gilligan and Trewin, who were living in the C.D.S., arrived and insisted on tossing up who was to go'. Squadron Commander Oliver agreed to this course and Gilligan 'won the toss and batted'!

The D.H. 4 left Great Yarmouth in company with the H. 12, N. 8666, at 10.30 a.m. that morning—the 5th. Squadron Commander Nicholl was in command of the flying-boat and the operation. Flight Lieutenant Leckie was the pilot of 8666, and Air Mechanics Thompson and Walker were the wireless telegraphic operator and engineer respectively.

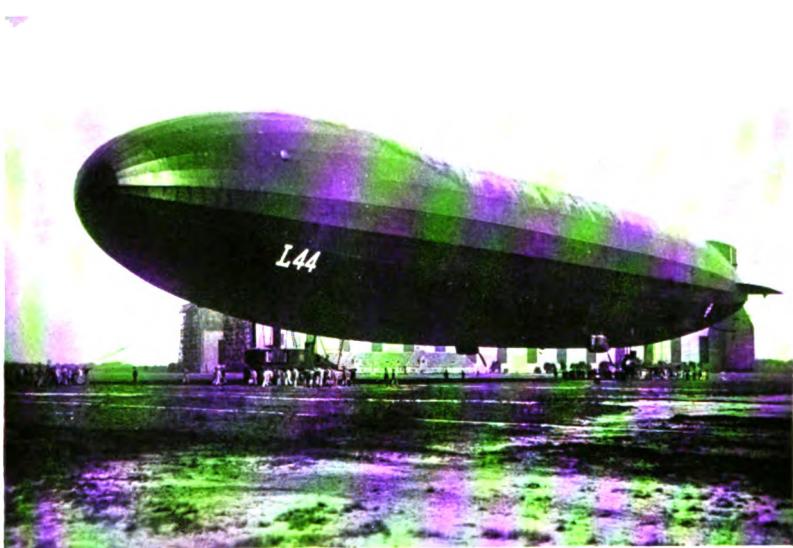
On leaving Great Yarmouth, Leckie arranged his rate of climb so that 8666 would be at an altitude of 12,000 feet (her ceiling) when over Terschelling Island; it was Gilligan's task to keep company with the flying-boat.

At noon, to the surprise of the occupants of 8666, when they were about 30 miles from Terschelling they sighted 2 Zeppelin airships; actually Nicholl saw them first. One of the airships was *L. 44* and the other *L. 46*. Both of them were at about the same height as the flying-boat, namely, 9,000 feet. For about 10 minutes Leckie 'stalked the airships', checking their course and speed with his own. When it was obvious that 8666 was overhauling them rapidly the following signal was made by Aldis lamp to the D.H. 4 (which was close to the flying-boat): 'Climb as high as possible and attack Zeppelins.'

To this message the following reply was received: 'Where are the Zeppelins?' As the two machines were now at practically the same height as the airships Nicholl's reply to this query was 'Dead ahead. Close and attack.'

Gilligan and Trewin then prepared to attack immediately—the course of the D.H. 4 being altered so that the pilot should gain height in order that he might be able to dive on *L. 44*.

In addition to the two Zeppelin airships the crews of 8666 and the D.H. 4 were soon to have to contend with the accurate fire of hostile surface craft. Gilligan reported subsequently that 'there were two divisions of two light cruisers and four destroyers each off Ameland about seven miles apart. Two of these cruisers were



*L. 44.*



of the *Stralsund* class and two of the *Hamburg* class, but it was noted that these two latter had no mainmast. A stern of these two divisions about ten miles, were two more divisions of mine-sweepers, also escorted by light cruisers.<sup>1</sup> Trewin photographed these ships but the negatives were lost when the D.H. 4 sank.

To return to the attack on *L. 44*, as the D.H. 4 was temporarily out of range, and the airship was ascending rapidly, 8666 closed as quickly as possible and opened the attack, and, in Nicholl's own words:

'At 12.30 p.m., I opened fire on the Zeppelin, our altitude was 12,000 feet and the Zeppelin 14,000 feet. She dropped water ballast and climbed still higher. The Zeppelin's number was *L. 44*. I continued attacking unsuccessfully for one hour, firing 400 rounds of anti-Zeppelin ammunition. The tracers were seen hitting the Zeppelin. During most of this time we were subjected to a heavy machine-gun fire from the Zeppelin. The Zeppelin, in the meantime, led me over a squadron of two light cruisers and four destroyers, which did not open fire, presumably on account of the proximity of the Zeppelin. The D.H. 4 was some distance away and was endeavouring to climb higher and at 1.30 p.m. signalled me that his engine was not pulling well and he could not climb any higher than 14,000 feet. I then signalled him to close and attack the Zeppelin, which he did without result.'

Both Gilligan and Trewin fired at the airship, but, in the words of the latter, 'our guns' appeared to have little effect upon the Zeppelin, other than to cause her to discharge her water ballast in an endeavour to climb still further. The aeroplane had reached its ceiling, and the Zeppelin, when she got higher out of our range, turned away.' While these two officers were firing at *L. 44* those aboard her 'returned the fire with her machine-guns and when we were underneath her she dropped bombs and incendiary flares'.

As soon as *L. 44* ascended out of range the enemy light cruisers and destroyers opened a rapid fire, with the result that, in Trewin's words, 'suddenly our airscrew came to an untimely rest, the engine having seized up owing to lack of water, presumably the radiator having been punctured'.

To return to Nicholl's account:

'At 2.0. p.m., the D.H. 4 signalled me that he had serious engine trouble and I signalled him to follow me and we would attempt to make Yarmouth.

<sup>1</sup> The D.H. 4 was armed with 5 machine-guns; during the action the aft guns jammed three times and one round of Brock ammunition exploded in the breech, but Trewin succeeded in clearing the gun.

On passing Vlieland on a course  $255^{\circ}$  another squadron of two light cruisers and four destroyers were sighted who heavily shelled us, making very good shooting, fragments of the shrapnel damaging the starboard wing. A large group of mine-sweepers were sighted at Texel Island. While attacking the *L. 44* a second Zeppelin <sup>1</sup> was sighted about 20 miles to the northward, steering a south-easterly course at an altitude of approximately 10,000 feet. She made off for Borkum Island at high speed and did not attempt to assist the *L. 44*.

The observation officer of *L. 46* was Oberleutnant Richard Frey, and he has been good enough to contribute the following note on this phase of the attack:

'... we had met *L. 44* at the end of our turning-point during the reconnaissance, and we were already drawing away from her again when we saw that a machine was trying to attack the ship. The attack was well planned, in so far that the machine had the sun behind it, and therefore could only be seen with difficulty by those aboard *L. 44*. We signalled at once to the latter: "Look out. Hostile aircraft," and her Commander, having been so warned, at once ascended to a great height, so that the enemy machine could not attack any longer.'

Before describing the succeeding events, the following account (supplied by a German officer) of the attack as viewed from the enemy's side may be of interest:

'At 12.15 p.m., two biplanes were sighted 50 nautical miles north of Terschelling. *L. 44* was at 4,500 metres (14,750 feet). As her recognition signal was not replied to, she rose to 5,000 metres (16,400 feet) and opened fire. The one machine which was directly under the ship was now distinctly recognized as a land machine, while the other was a flying-boat. The land machine fired tracer and explosive bullets. Clouds of smoke lay behind and round the ship. *L. 44* went up to 5,500 metres (18,000 feet). The attack was renewed in the same way, the machines attacked from aft and opened fire as soon as they had reached their greatest height. They found it difficult to remain at this height, and after a time went down, turned and made a fresh attack. This was repeated 4 or 5 times. After 35 minutes the flying-boat received a hit and abandoned the fight.'

*8666* was not hit by the fire from *L. 44*, but, as already mentioned, by fragments from the shells fired by the anti-aircraft guns aboard the cruisers and destroyers.

The attack was now over and it had proved a failure; the airship was right out of range, the engine of the D.H. 4 had seized up, and the machine was gliding towards a heavily breaking sea, and Gilligan was faced with the task of alighting on it in a machine

<sup>1</sup> *L. 46*.

without any floats or flotation bags. The descent took about a quarter of an hour or 20 minutes, but before this Gilligan has said that:

'Trewin and I had an argument as to which way the wind was blowing, so that we could land head on. I took my chance and about 10 feet up "pan-caked"—a horrid crash and all I could see was blue water above. I couldn't free myself and after trying everything (for I had blown up my waistcoat before crashing) I suddenly remembered my headphone attachment was still plugged in—this was all that was keeping me down. As soon as I disconnected it, up I shot, to find Trewin swimming towards the relics of the machine.'

Nicholl and Leckie were now in this predicament: the port engine of 8666 was giving a great deal of trouble (the contact breaker of one of the two magnetos was broken so that the engine was only running on one bank of cylinders), and both knew that, because of this, the return journey would be fraught with anxiety. But now (that is, just before the D.H. 4 alighted) within a few feet of the angry sea were two of their brother officers—in a land machine. What was Leckie to do? If he alighted to pick up Gilligan and Trewin he might crash in the sea that was running; if this did not happen, then both Nicholl and Leckie *knew* they could never hope to get off the water again, and then they might all be lost. Supposing they did not pick up the crew of the D.H. 4, but struggled home the best way they could and then sent out machines and ships to find Gilligan and Trewin, could they be sure that they would be saved? All this had to be settled, as one brother officer afterwards remarked, 'not in the heat of an action but in the dreary stretches of the North Sea *and at once*'.

To those who knew Nicholl and Leckie there was only one answer to these questions—to their undying honour and to that of the Service—'they never hesitated one moment—Bob Leckie simply shoved the nose of 8666 down and went straight for Gilligan and Trewin'.

So quickly did Leckie descend that 8666 went into a 'flat' spin and was practically uncontrollable for about 3,000 feet of the descent. Leckie managed to pull her out of the spin and alighted without damaging the machine and then taxied up to the D.H. 4. Both Gilligan and Trewin did not remain clinging to the wreckage but started swimming towards 8666, and they became separated. Gilligan was the stronger swimmer and was dragged aboard the flying-boat fairly quickly, but great difficulty was experienced in saving Trewin, and he was nearly drowned when they did get him

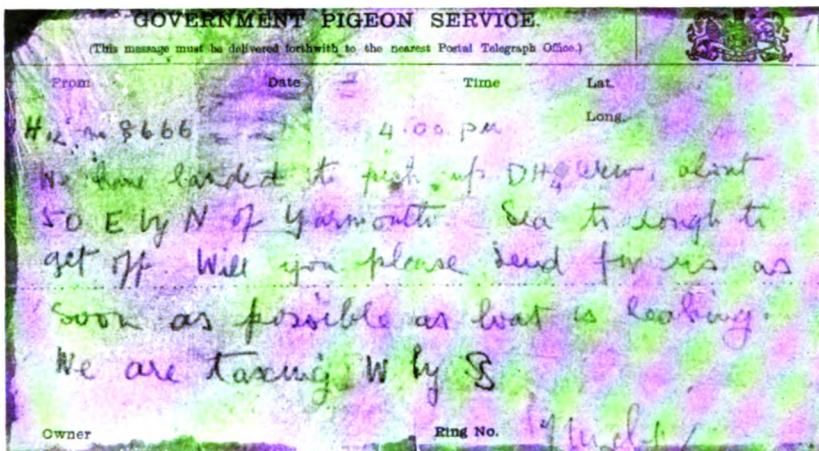
finally on board. Only the fine seamanship displayed by Leckie prevented both these officers from being drowned, weighted as they were with thigh-boots and leather coats. The wreckage of the D.H. 4 sank almost immediately, but, curiously, some weeks after one of the wheels of the undercarriage was washed up on the shore opposite the air station.

8666 now had six men aboard, and all Leckie's attempts to get her off the sea failed, 'for a very heavy sea was running and the port engine was dud'. So now he was faced with the task of taxi-ing towards England in an overloaded boat with a heavy following sea, and with the knowledge that there was not sufficient petrol aboard to complete the journey. To add to all Leckie's and Nicholl's troubles 8666 was found to be leaking badly, for a shell splinter fired from the guns of one of the enemy's ships had torn a jagged hole in the hull near the 'step'. The ends of some empty petrol tins were knocked in hastily, and the crew of the boat and Gilligan and Trewin started to bail—literally for the lives of all.

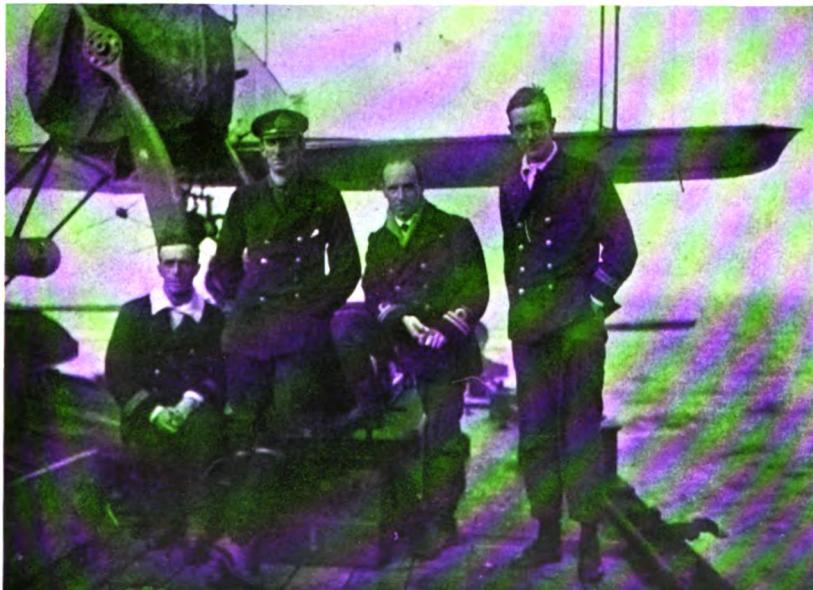
Leckie then, in his own words, 'started to taxi towards England'. He steered a magnetic course  $260^\circ$ , but he soon found that owing to the very heavy following sea it was impossible to keep 8666 on that course, for, owing to the short, steep seas, the tail of the hull was being lifted constantly high up into the air and the oncoming surge would push the bows under and 'literally hundreds of gallons of water' would pour into the front cock-pit. After proceeding for some time like this Leckie decided that if he were to avoid swamping the hull he must ease 8666 over the rollers, and so he altered course to about  $300^\circ$  magnetic in the hope that he might reach the War Channel near Cromer, but the supply of petrol would not permit this. Had it lasted out the subsequent story might have been different, for, as Leckie stated afterwards, he considered that 'if we had been able to remain on our course, Galpin and Fetherston in the other H. 12, 8660, would have found us the next day, as they made a zig-zag patrol to Terschelling which would have covered our position. Other ships would also have been in our vicinity.'

Leckie stuck grimly to his task with the water nearly up to his knees, while the others went on bailing.

It was not possible to communicate with the air station by wireless telegraphy, but they fortunately had four carrier pigeons on board, and, at 4.0 p.m., Nicholl released two of them, each bearing the message: 'H. 12, N. 8666. We have landed to pick up



The pigeon message of September 5, 1917, sent by Squadron Commander Vincent Nicholl from H. 12, 8666.



Flight Lieutenant G. H. Trewin, Squadron Commander Vincent Nicholl, D.S.C.,  
 Flight Lieutenant R. Leckie, D.S.C., and Flight Lieutenant A. H. H. Gilligan  
 aboard H.M.S. *Halcyon* after their rescue.



D.H. 4 crew about 50 E. by N. of Yarmouth. Sea too rough to get off. Will you please send for us as soon as possible as boat is leaking. We are taxying W. by S. V. Nicholl.' One of these pigeons and its message was never seen again, and the message from the other one did not reach the air station until 11.30 a.m. on the Saturday, the 8th.

At about 7.30 p.m. on the Wednesday evening (the 5th) both engines of 8666 stopped running for lack of petrol, and now, on a dark and cold autumn evening, six men, faint with sea-sickness, wet through, and exhausted with bailing, with no food on board (they had taken some with them, but had eaten it before the attack on *L.44*) and with less than 2 gallons of fresh water in a petrol tin, were faced with the task of keeping a badly damaged flying-boat from sinking. Nicholl would allow none of them to smoke for fear of aggravating their thirst. All through the pitch-dark night, in a heavy sea, those six men strove to keep 8666 afloat—bail—bail—bail—no food—no light—all took a hand at bailing, officers and men, and Leckie and Nicholl took hourly spells in holding the rudder amidships, for this was found to prevent the machine from yawing so badly. They had no sea anchor, but made 'a sort of a one out of five petrol tins tied together', but it did not prove of much use.

During the night the wing-tip float of the damaged starboard wing was carried away, so each man *rested* from bailing by crawling on to the other wing—so as to keep the damaged one out of the water—and stayed there for two hours. There, unseen by his fellow bailers, he clung to one of the struts, washed by heavy seas, until his turn came to bail, and so on all through the night, and for three weary days more. It was found impossible to sit or stand on the wing, so the officer or man whose duty it was to be there lay on his stomach and held the outer strut between his clenched hands and braced his legs against another. It 'was a terrible job', for, as one of the party has remarked since, 'one minute we'd be at least 20 feet up in the air, the next minute down the wing would come with a hell of a crash and we'd be buried under water, to be jerked out, spitting and gasping, half-drowned, to go up like a see-saw and then down again—but still, we managed to stick it'. Through all this ordeal none behaved more splendidly than did the two mechanics, Thompson and Walker.

Some account must be given now of the attempts made to rescue them, for by the afternoon of Wednesday (the 5th) those

at the air station began to feel anxious at the non-return of their brother officers, for if the machines had not landed in enemy or neutral territory it was realized that they must have been forced to alight on the sea. Towards the evening the position was a serious one, as no message had been received from either of the machines since their departure. The commodore at Lowestoft (Commodore A. A. Ellison) and the admiral at Immingham gave orders that evening for destroyers, drifters, trawlers, and motor launches to leave immediately to search for the two machines, and a division of destroyers left Harwich to search around Terschelling; and every available pilot at the air station searched for their brother officers until dark. By the next morning (Thursday, the 6th) large numbers of warships, airships, aeroplanes, and seaplanes were searching a wide area. The Senior Naval Officer at Great Yarmouth (Commander Hodgson) alone sent out 2 trawlers, 10 steam and 8 motor drifters, and 5 motor launches, and every available pilot and machine again spent all day looking for their brother officers—and this search was kept up till they were found.

At 5.0 a.m. on Thursday (the 6th) Flight Lieutenant Galpin and Flight Sub-Lieutenant Fetherston left in the other H. 12, *N. 8660*, went over to Terschelling, searched the area around the Island, but saw nothing of 8666 and came back on the course that the D.H. 4 and 8666 would have followed normally; but for the reasons already given by Leckie, those in 8660 missed seeing their sister boat.

Meanwhile conditions aboard the flying-boat were growing worse. On the Wednesday (the 5th) all night long a heavy sea was running, the boat was leaking, all aboard were wet through, hungry, thirsty, exhausted, and violently sea-sick, but all the time were cheered by the indomitable spirit shown by Nicholl and Leckie, both of whom set a magnificent example of untiring devotion to duty.

Leckie by now was very ill—continual sickness had caused internal haemorrhage and he was spitting blood constantly—but, though dazed and semi-conscious, he still took his turn at bailing and holding the rudder. Trewin, too, was in a very bad state, for it may be remembered that he was nearly drowned—terribly weak—but, like Gilligan, he never wavered and stuck to his task of bailing.

At about 7.0 a.m. the next morning (Thursday, the 6th) Nicholl

released another pigeon, bearing a message stating that they had probably drifted northwards. This bird was never seen again. In the afternoon of the same day, at 3 p.m., he released the fourth and last pigeon, which carried the following message:

'3 p.m. Very urgent. Seaplane 8666 to C.O. Air Station, Great Yarmouth. We have sighted nothing. The wind has been drifting us west-north-west ever since we landed, so we may have missed Cromer. We are not far from the coast as we keep seeing small land birds. Sea is still rough. Machine intact still. We will fire Véry's lights every forty-five minutes to-night. V. Nicholl.'

This message was received at the air station at 10.45 a.m. the next day, Friday (the 7th).

Meanwhile, all aboard 8666 held on grimly with the task of bail—bail—bail—despite being exhausted by lack of food, seasickness, exposure, and the exertion of bailing. They 'started to lose count of time', and appeared to be living 'in a kind of haze'.

The full story of the happenings aboard 8666 will never be told. Nicholl 'has rejoined most of his friends and the flower of his generation'. Leckie, while happily alive, like Nicholl will never speak of those days.

By the next morning—Friday, the 7th—although a large number of His Majesty's ships, airships, land machines, and seaplanes had been searching for them, nothing had been heard or seen of those aboard 8666.

Attention must be devoted now to one of the searching ships—H.M.S. *Halcyon* (Lieutenant Commander B. S. Bannerman, R.N.)—an old gunboat that was based on Lowestoft, and which had patrolled off the Norfolk coast ever since the War started. It may be remembered that she was the first ship to be engaged by the German battle cruisers when they shelled Great Yarmouth on November 3, 1914. Lieutenant Commander Bannerman had on several occasions been responsible for the saving of the lives of pilots from the air station, who had been forced to alight on the open sea.

To increase the efficiency of her patrols it had been the custom for some time for the *Halcyon* to carry on board a Schneider seaplane and a 'duty pilot' from the air station. When needed the seaplane was hoisted outboard by a derrick, and her pilot then flew in a prescribed area and reported anything untoward to the ship on his return. The machine was armed with a 60-lb. bomb for use against submarines. The pilot, during the days under

immediate review, was Flight Sub-Lieutenant E. A. Bolton (who had joined the air station the previous month), and he has contributed the following account of how the captain of the *Halcyon* was instrumental in saving the lives of those on board 8666, and of how he (Bolton) salved the flying-boat:

'On awakening, on the morning of September 6, I was surprised to find the ship under full steam, and I had not been called at dawn to test the seaplane engine in accordance with the general practice before starting the day's patrol. The Surgeon and myself were the only occupants of the Ward Room, the other officers having apparently breakfasted earlier and already set about their duties. Having fed, I went on deck and saw at once that something different from the ordinary routine was happening. The Captain was on the quarter-deck and told me that we were looking for two Yarmouth machines missing from the day before. Our position was, he said, about 60 miles west of Terschelling light vessel, and our course was still east. "If only", he said, "I had a gun that would get half-way to the worst-armed German, I would go right in to where they were last reported." He was very upset at the loss of 8666 and the D.H. 4, but as no signs had been seen by noon, the course was altered west and the following morning (the 7th) found us off Lowestoft, where it was the usual routine for us to call for stores once a week. The Captain went ashore on this occasion, and on his return he summoned me to his cabin. He had seen Commodore Ellison and Admiral Sueter. There was still no news, except a pigeon message, in which Nicholl had said "... may have missed Cromer. . . ." <sup>1</sup>

'The area from Terschelling to Yarmouth had been, and was being searched by destroyers and other craft without success, and, if the missing machines were not found that day, it was the reluctant intention of the Admiralty to recall the searching vessels, as, three days having elapsed, there was little hope of the flying-boat having survived. Lieutenant-Commander Bannerman concluded his remarks by saying that he had obtained the Commodore's permission to devote the remainder of the week to a private search, and he said to me, "We are *going* to find them. Now, what about it?"

'We got from Yarmouth the amount of petrol on board 8666—the time the patrol started—the time and position of the Zeppelin which had been attacked and wirelessed distress signals, together with the wind speed and direction. We had the last position of the attacked Zeppelin, and the amount of fuel approximately left on 8666 at that time. We also knew that 8666 had not been shot down because of the pigeon message. It was, therefore, fairly certain that either she had run her petrol short and failed to make land, or she had had engine trouble, landed and taxied and then failed to make land. The message seemed obviously to indicate that they were somewhere north of Cromer.

'On these assumptions the courses were laid down and when allowances

<sup>1</sup> Released at 3.0 p.m. Thursday the 6th.

had been made for the effect of wind and currents, three very probable positions were possible:

1. The extensive minefield off the Wash, an area not likely to have been searched by aircraft.
2. An area north-by-east of Cromer.
3. On a line slightly north of Cromer-Terschelling and about the middle of the North Sea.

'Bannerman decided to proceed to Haisborough light vessel and lay off there for the night, so as to be close to Areas 1 and 2 at dawn. His orders to me were to search the minefield at dawn, while the *Halcyon* steered for Area 2, and I was to rejoin the ship in two hours. Luckily the day was fine, though the visibility was only fair, owing to haze. Unfortunately, the Schneider was found to be out of action, owing to one of the body turn-buckles having torn away from its fastening. With the aid of the ship's Carpenter we endeavoured to effect a repair, but were unsuccessful. This was very disappointing, but about half an hour later we sighted and signalled a Coastal Airship<sup>1</sup> whose pilot informed us that he had searched very thoroughly the minefield without result.

'Lieutenant-Commander Bannerman estimated reaching Area 2 between 1.0 p.m. and 2.0 p.m. By noon, the visibility was much better—about three miles from the deck of the ship—the wind having freshened considerably and dispersed the mist.

'At 12.45 p.m., we were at lunch when a seaman rushed into the Ward Room—"The First Lieutenant reports he believes he has sighted the sea-plane about five miles right ahead." Lunch was forgotten, and by the time we had got on deck the sun glistening on the planes removed any doubt that our search had not been rewarded, and we hoped that all would be well. As we drew near, we manned ship and gave them a heartening cheer, to which those aboard the flying-boat tried to answer. A boat was lowered, and I had the privilege of being sent out to 8666. I can hardly describe the joy of meeting comrades one has feared as lost, as Yarmouth, at that time, was a small but happy station. We were very pleased indeed to see Trewin and Gilligan, who had been picked up by 8666.

'They were all bearing traces of their terrible experiences. It was the third day they had eaten no food. They had only 2 gallons of fresh water on board, and had had to tap the engine radiators and slake their thirst with the rusty water in them.

'We got them on board the *Halcyon*, where they were looked after by Surgeon Willes.'

At 12.42 p.m. (Saturday, the 8th) the captain of the *Halcyon* sent the following message by wireless telegraphy to the commodore: 'Have found the flying-boat in 50° 36' N., 1° 55' E.<sup>2</sup> Six men all well. Will tow back.'

<sup>1</sup> C. 26.

<sup>2</sup> About 100 miles to the north-east of Great Yarmouth.

To return to the subject of the pigeon messages, at 11.30 a.m. that morning—Saturday—the message which Nicholl had sent three days earlier (at 4.0 p.m. on Wednesday the 5th) was delivered at the air station. The pigeon—No. N.U.R.P./17/F. 16331—had fought its way to land, but had died, apparently, from exhaustion on gaining the shore. Its dead body was found, by a stroke of good fortune, at Walcot near Bacton, by Second Lieutenant D. W. Hughes, 'A' Company, 4th Battalion Monmouthshire Regiment. He picked it up that morning at 11.0 a.m. and gave it to a military signaller, who took the bird and its message to the station officer of the War Signalling Station at Bacton. This officer then had the message transmitted by telephone to the Senior Naval Officer at Great Yarmouth. Unfortunately a mistake was made in telephoning the message: it ran, it may be remembered, 'We have landed to pick up D.H. 4 crew about 50 E. by N. of Yarmouth . . .', but the 50 miles was received as 15 miles, with the result that the searching vessels and aircraft were ordered to search close inshore. Fortunately, 8666 was found less than two hours later, otherwise the mistake might have had tragic results.

The pigeon was stuffed and kept in the Mess; on the case was fixed a brass plate bearing the inscription 'A very gallant gentleman'.

Leckie paid the following tribute to this bird, saying:

'had it not been for the fact that a pigeon *had* arrived home with the information that we were alive on the previous day, I doubt if Bannerman would have resumed the search, or if he would have been given permission to do so. Had not the pigeon message said ". . . may have missed Cromer . . ." there would have been no reason to search so far north (indeed wind and currents were setting us south-west most of the time). Nevertheless, the above does not lessen my appreciation of the tenacity of purpose, or the skill shown by Lieutenant Commander Bannerman and Bolton in piecing together the slender evidence.'

To return to the homeward voyage of 8666, Bolton subsequently described this journey as follows:

'With six ratings and a Chief Petty Officer I returned to 8666. She was in a sorry plight, her floor-boards awash, with the right wing heavy, owing to a broken wing-tip float. We set to work to bail her and two men were detailed in turn to stand on the good wing-tip, in order to lift the damaged one out of the water. The *Halcyon* then passed us a line to which we made fast—and then we started for home—about 100 miles south-by-west. At first it was a pleasant trip, then the sea got up and we were all soaked by

the water and spray that came aboard. However, as the water was got under control in 8666, she started to ride better.

'By about 6.0 p.m., the sea moderated, and we were able to increase speed from 5 to 12, and later, to 15 knots. In response to Lieutenant Commander Bannerman's request, the lights had been lit in the War Channel and the light of the Haisborough light vessel was the first to welcome us. We reached Yarmouth just about midnight, and it was not long before the C.O., Squadron Commander Oliver, and as many officers who could pack into 807, the station motor-boat, came aboard. Oliver instructed me to make 8666 fast to a mooring buoy, a job which, on a pitch-black night, without any lights save lanterns, and a strong current, was easier said than done—the first trouble being to find the buoy! However, after some adventures, it was done and 8666 was home once more.'

The occupants of the flying-boat were taken to the air station, put to bed, and given medical attention. Next morning Nicholl made a short flight in a B.E. 2c in order 'to steady his nerves', and three months later, almost to the day, went out in 8666 with another D.H. 4 in attendance to attack a Zeppelin airship which was off Terschelling. The D.H. 4 experienced engine trouble and only just managed to make land, and, on the homeward journey (which lasted over 3 hours), Nicholl was expecting momentarily to have to alight, pick up the crew of the D.H. 4, and then perhaps undergo once more days of terrible privation. The pigeon was not the only 'gallant gentleman'.

Nicholl, with characteristic modesty, chronicled the events of those five days in September in the following words:

'We drifted from 7 p.m., on the 5th inst., to 2.0 p.m., on the 8th inst., when we were picked up by H.M.S. *Halcyon* and towed to Yarmouth.' His only regret being that 'we did not succeed in destroying the *L.44*'.

Some months later (May 1, 1918) His Majesty the King appointed Squadron Commander V. Nicholl, D.S.C., a Companion of the Most Honourable Distinguished Service Order 'for zeal and devotion to duty during the period from July 1 to December 31, 1917'. A similar honour was conferred also upon Lieutenant Commander B. S. Bannerman and Flight Lieutenant R. Leckie, D.S.C.

A great deal of flying was done at the air station throughout September, especially on anti-submarine patrols—6,308 miles as compared with 3,880 in August.

On the 21st a hostile submarine was attacked by the pilot of a Short seaplane. At 5.30 a.m. Flight Sub-Lieutenant Davern,

with Air Mechanic Haythorpe as his observer, left in a Short seaplane on an anti-submarine patrol to Smith's Knoll pillar buoy, Haisborough light vessel, and the War Channel. Four hours and ten minutes later a submarine was sighted to the west of the Cross Sands light vessel. Immediately the seaplane approached she submerged, and two 100-lb. bombs were dropped over her presumed positions; but no results were observed, and it is known now that she was not sunk.

Although Zeppelin airships had been very active throughout the year in the North Sea they had raided this country only six times, but on the night of October 19/20 13 Zeppelin airships set out from Germany on a raid, although only 11 crossed our coast.

Abnormal climatic conditions prevailed during this night, for, while perfect calm reigned over the North Sea and this country at low altitudes, and only light, north-westerly winds up to 10,000 feet, above that height this wind suddenly increased in speed to 40 miles an hour, and progressively higher up, so that, at 20,000 feet (the only safe height for raiding airships), it was blowing a full gale from the north and north-west. The enemy were ignorant of this fact. One of their Zeppelin airship commanders (Kapitänleutnant Waldemar Kölle of *L. 45*) who took part in the raid has stated:

'Another raid time had arrived. The weather during the previous weeks had been so bad that for a long time the airships had scarcely been out of their sheds, and we had been looking in vain for a change in the weather conditions. At last, more settled weather had arrived, but it was still far from good. We of *L. 45* were at that time sharing our shed with *L. 54* . . . .

'On October 19, at about 9.0 a.m., the order came over the telephone: "Airships stand by for raid. Ascent 12 p.m. Further particulars after completion of the morning's weather chart." We studied the latest weather reports, conditions were certainly favourable. There was an even distribution of pressure over north Germany and the North Sea, with gentle winds at all altitudes, and there was nothing to indicate the possibility of a sudden change, the only grounds for misgiving lay in the suddenness with which the calm had come, after weeks of exceedingly bad weather. There was the possibility of a reaction, and perhaps a quick one. It was, in such cases, that the great disadvantage was felt of getting no weather news from the west, particularly from England and from France. The further westward the weather stations, the more reliable the conjectures from their reports, for the dirty weather in our districts comes from the west. Our most westerly station, during the War, was Bruges. The reports from the station at this town were, therefore, the most important for us, so we had to wait

for reports from Bruges in the morning, in order to get a clear idea of the general situation.

“Later on in the morning, Fregatenkapitän Strasser called me up on the telephone. First came the final order: “Ascent at 12—middle England—weather report to be given at 5 in the afternoon, at 9 in the evening, and wind calculations in the usual sequence.” And then he added: “The weather conditions are good, Kölle, push right on into the interior. Good luck!”

“The morning weather report had shown no change in the situation. Owing to lack of visibility, there was no report of winds at high altitudes from Bruges. All other reports gave south-westerly to westerly winds for all altitudes. There was the likelihood of a veer to the north-west. We got into the air punctually at 12.0 p.m., and *L. 54* followed us 20 minutes later.”<sup>1</sup>

The airships left their bases in Germany just after 1.0 p.m. (October 19) and all but two crossed our coast. Those that did so were *L. 41*, *L. 44*, *L. 45*, *L. 46*, *L. 47*, *L. 49*, *L. 50*, *L. 52*, *L. 53*, *L. 54*, and *L. 55*. These airships came from the stations at Tondern, Ahlhorn, and Wittmundhaven. The instructions they had received from Strasser were: ‘Central England to be raided.’ The movements of these various airships will now be outlined.<sup>2</sup>

All the airships crossed the coast at various points between Withernsea (*L. 45*, Kapitänleutnant Kölle) and the neighbourhood of Bacton (*L. 54*, Kapitänleutnant Freiherr von Buttlar), and all did so between 7.30 p.m. and 8.0 p.m. The most westerly point gained was Birmingham. This place was reached by *L. 41* (Hauptmann Manger). Although a number of bombs was dropped from this airship, no casualties resulted and little material damage was done. Only one of the airships bombed London. This was *L. 45* (Kapitänleutnant Kölle) which dropped bombs on Hendon, Cricklewood, Piccadilly (in the Circus, opposite the shop of Swan & Edgar, Limited), Camberwell, and Hither Green. As a result 31 people were killed and 48 injured—in fact, the bombs dropped by this airship were responsible for the majority of the casualties caused during this raid.

The anti-aircraft authorities gave orders that the London defences should not go into action, for, as there was a thick ground mist, the searchlights would have been unable to penetrate the atmosphere, but the scattering of the light of the beam would have caused considerable general illumination which would have

<sup>1</sup> *Marine Rundschau*.

<sup>2</sup> Vide also *The German Air Raids on Great Britain, 1914-1918*, pp. 178-88.

acted as a guide to the enemy airships. Largely owing to the result of this order the raid became known as 'The Silent Raid'.<sup>1</sup>

The remaining 9 airships raided the midland and eastern counties, and although some 13½ tons of bombs were dropped (with the exception of the raid of September 2, 1916, the largest weight dropped by enemy airships during the War) the casualties were comparatively small; 36 people were killed and 55 people were injured. The material damage inflicted was not of a serious nature.

The enemy suffered severe losses—losing 5 airships—and this loss was attributed directly to the changes in the weather and particularly to the gale that was blowing at an altitude of 20,000 feet.

Before describing the way in which the loss of the raiding airships occurred, a short account of the action of pilots from Great Yarmouth air station during the raid will be given.

The two Zeppelin airships which came near Great Yarmouth were *L. 46* (Kapitänleutnant Hollender) and *L. 54* (Kapitänleutnant Freiherr von Buttlar). It was known at about 6.0 p.m. at the air station that 'an air raid by Zeppelins was imminent', and altogether 5 pilots ascended to the attack, namely, Flight Commander Cadbury and Flight Lieutenants Walker, C. S. Nunn, Halford-Thompson, and C. S. Iron. The first of these pilots ascended from Great Yarmouth, the second and third from Burgh Castle, the fourth from Bacton, and the fifth from Covehithe. Only one of these officers—Flight Lieutenant Nunn—sighted the enemy, and he chased *L. 54* (Kapitänleutnant Freiherr von Buttlar) 20 miles out to sea, but was unable to press his attack home. Nunn crashed on landing in the darkness, and a similar fate befell Halford-Thompson and Iron.

Flight Commander Cadbury described part of his experiences that night in a letter where he said:

'A Zeppelin was reported approaching Yarmouth from north-west, so Nunn went up from Burgh Castle, and I soon followed from Yarmouth. I prevailed upon the C.O. to let me go up, which he did finally. I managed to get off safely, in spite of a strong west wind, which rather complicated matters. I climbed up to 6,000 feet without much difficulty, except that a silly ass in charge of a battery would keep picking me up in his searchlights. I climbed up through the clouds to 9,000 feet, where I cruised about for some time. I got completely lost above the clouds, as the wind was blowing with considerable force from the west up there. The clouds thickened to

<sup>1</sup> Vide also *The Defence of London, 1914-1918*, pp. 215-21.

6,000 feet while I was up, and so when I throttled down to come down, I got a nasty jar when I saw my altimeter dropping to 3,000 feet before I got clear, because the clouds were originally at 6,000 feet. However, I went through them again, but decided it was too dark to achieve anything.'

The 'All Clear' signal came through at about 2.30 a.m. in the morning, and by that time the enemy airships were in dire straits.

Two of the airship officers who took part in this raid subsequently recorded their experiences.<sup>1</sup> One was Oberleutnant Richard Frey (the observation officer of *L. 46*) and the other Kapitänleutnant Waldemar Kölle, the commander of *L. 45*.

The former, after stating that *L. 46* left Ahlhorn at 1.20 p.m. in the afternoon of 'a beautiful sunny autumn day with a light covering of cumulus clouds, and that they met good weather over the North Sea', said:

'After some little time we found out that the wind on our starboard quarter was turning west to north-west, which was very favourable for our operations. As twilight came on, however, it became obvious that the wind was veering still farther to the north and at the higher altitudes was beginning to freshen. A request for our position by wireless confirmed this view and also proved that we were considerably to the south-east of our supposed position. The meteorological stations had only given us wind speeds for altitudes up to 3,000 metres (9,850 feet) for no kite-balloon ascents had taken place that day, and the wind speed had only been measured to the height of the clouds with small balloons. Although we corrected our course sharply to the north upon receipt of the wireless signal, we were to find at our next call that we had again drifted southwards. The wind had gone round to the north and had increased in strength very considerably, so that at 7.0 p.m. it was, unfortunately, already quite clear to us that the hoped-for penetration into the industrial areas of England was no longer possible. It was now a question of our giving the fullest attention to navigation.

'The wind continued to freshen and, in spite of constant corrections to our course, we continued to drift southwards. The ship naturally could only advance very slowly against the extremely strong headwind. Owing to it being a north wind the temperature was very low indeed. At an altitude of 6,000 metres (19,700 feet) we had an icy temperature of minus 38° C., so I do not need to lay particular stress on the fact that we had wrapped ourselves up like Esquimeaux. About 11.0 p.m. the English coast came in sight. We were steering a compass course north-north-west, and saw before us the unmistakable U-shaped bay of The Wash, instead of the mouth of the Humber, which proved the futility of any hope of our reaching the Humber. . . . At 11.20 p.m. we stood over the north coast of Norfolk, straight to the north of Norwich, which we, therefore, decided to raid.

<sup>1</sup> *Marine Rundschau*.

While we had, up to this, scarcely made any headway, the ship now raced through the air before the wind, on a southerly course as if possessed by the very devil. In ten minutes we had covered the distance from the coast to Norwich. Before the defence was ready for us I had already dropped the whole lot of my bombs on the town.<sup>1</sup> From this furious speed it was clear that the wind had grown to a hurricane. To our further undoing it had veered still more to the right, so that it was now blowing from north-north-east to north-east. At midnight we crossed the coast near Lowestoft, all the while under heavy fire.

'Naturally we tried to reach the North Sea, for we hoped that there we should soon be able to go down to lower altitudes, where perhaps we should meet less violent conditions. The north-easterly storm was stronger, however, than our five 260 b.h.p. engines. We were steering a north-easterly course by the compass, but on it were sailing away to the south-west, without gaining any ground to the east! . . .

'For some hours now our wireless operator had noticed that all trace of organization in wireless intercourse had disappeared—it was simply impossible to get a wireless message through. The airships were wirelessing pell-mell and quite regardless of each other. Position by wireless was constantly and urgently requested, unhappily without success. One ship even sent out an S.O.S.—the international signal of distress at sea. There was no doubt that various ships were in distress and a dread foreboding filled us all. . . . Our condition now became extremely critical and required our fullest attention. Every one in the ship was aware of the seriousness of the situation and no unnecessary word was exchanged. To such an extent was our attention entirely concentrated on the management of the ship that we never even noticed the wholly unbelievable cold. Should one engine give out now, we were done for and would drift, irretrievably lost, down over the Front and into France. Already we could see the flash of the star-shells along the Flanders front. It was quite evident and certain that we could no longer reach the North Sea now,<sup>2</sup> for to go down lower was impossible, for once there we should fall a victim to the defences. We dared not also go over the Front, for there we should become the sure prey of aircraft. By now we had got to act and quickly. The Commander<sup>3</sup> came to the only right decision—we must attempt to get away over Holland into the German industrial area. Our magnificent engines did not fail us. In spite of going "full-out" all the while, they were continuing to run smoothly—we were quite well aware that our flight over Holland constituted a breach of neutrality, but it was a question of saving our ship, and all other thoughts took a back seat.

'At 2.15 a.m., on the morning of October 20, we crossed the coast by the

<sup>1</sup> Actually he passed well to the west of Norwich, and the bombs he dropped fell at Walcot and East Ruston, killing two horses.

<sup>2</sup> He would appear to be mistaken here, for, according to our knowledge of his movements, he never came over this country again, after going out to sea at Lowestoft.

<sup>3</sup> Kapitänleutnant Hollender.

Hook of Holland and were thereby safe for the first time, because the danger of being driven over the Front into France was now over. It was as if a load dropped from all our hearts! An entirely unbroken layer of clouds lay at an altitude of 3,000 metres (9,850 feet) over Holland, and this served us in very good stead for, because of it, probably no one in Holland had noticed anything of our flight, especially as at 2.0 a.m. all were peacefully asleep! Owing to the covering of the clouds we were able to go down to 4,000 metres (13,000 feet) where the wind was somewhat less violent, and we were able to make our way eastwards more rapidly.'

After being fired at in error by German anti-aircraft defences, *L. 46* landed at Ahlhorn under conditions of great difficulty, having been in the air for nearly 24 hours.

Kapitänleutnant Kölle, of *L. 45*, after stating that over this country he experienced similar conditions as did Frey, and that he bombed London, added that, after crossing the Channel (which he did slightly to the east of Hastings):

'The engines were running "full-out" yet the ship turned slowly and with difficulty against the wind. It was not a wind, it was a gale. With terrible, almost sinister speed the lights below us had passed beyond. No search-lights reached us now. They were all still seeking, and more wildly and confusedly than at first. We were driving onwards, and at an incredible rate, to the south, and continued to drive on when the ship at length lay on its course. With frightful speed the view below us moved past.'

He then tried to descend, but when over France his airship was attacked by aircraft. To add to his difficulties Kölle's wireless telegraphic signals remained unanswered, and at 3.0 a.m. (October 20) one engine broke down. The crew began then to show signs of exhaustion, because they had been forced to breathe in a rarified atmosphere for such a long time. Moreover, 'the new liquid air apparatus, which had been issued only a few days previously, had broken down on the outward journey through lack of experience' on their part. They still had four oxygen tubes 'of the old kind', but the engine-room ratings became so weak that they were unable to 'regulate the radiator shutters before the water in them froze, because of the icy cold'. Kölle then debated whether he should alter course to the south-west and land in Spain ('which would mean the surrender of the ship'), or whether he should 'make the desperate attempt' and head to the eastward and try and land somewhere in Germany. He chose the latter course—'military reasons won the day and nailed the decision'. The gale was so strong that they 'did not journey over France,

but tore over it'. The officers and crew felt the strain more and more, for:

'We just drove on—and on, and the reaction from the uninterrupted strain and stress and the nervous tension that had been stretched to breaking-point began to make itself felt. A certain inclination to put up with the course of things as inevitable was supported by this relaxation. Now, for the first time, we were aware of the extent to which the continual lack of oxygen had weakened our limbs and muscles. I, myself, found what an exertion it was to stand or move, and felt the need of the scanty support of the ship's side, and I was aware of a headache and a certain slowness in thinking. I also noticed with alarm what demand I had to make on my voice and lungs to make my orders and questions audible—and how feeble and laboured were the replies of the others.'

At 8.0 a.m. he was over Lyons—and was shelled—and Kölle saw machines leaving the ground to attack him, but they 'remained far below our altitude of 6,300 metres' (nearly 21,000 feet). Then his engineer ('pale, and at the end of his strength') told him that there was 'only just about enough petrol for a good hour'—'so now, it was just a question of one thing. The ship was as good as lost, but the crew must be saved', whereupon he gave orders that a landing was to be made and the airship destroyed. Their difficulties were increasing continually, for:

'By now, only two engines were running. The ship lay with its rudder jambed hard over. We yawed and rolled, and the rudder handwheels were in constant motion. The side steersman was completely done up. On his return the Observation Officer<sup>1</sup> took his place. It was only the work in hand and the excitement that was keeping us all up. About 10.0 a.m. we had crossed the valley of the upper Durance at a height of 1,000 metres (3,280 feet) and were seeking a suitable place to land. All around us was the Alpine landscape of the Hautes Alpes.<sup>2</sup> The wind was still north-east and with our course set to it we saw a plateau surrounded to the north and east by a high mountain chain. There the Bueche flows from the north into the Durance and in its valley we should surely find shelter from the gusty wind. I set about preparing for the landing.'

Thereafter Kölle succeeded in landing his badly damaged airship. He then had her set alight, and afterwards was captured, together with his crew.

So ended the career of *L. 45*. During the 6 months of her existence (April 7 to October 20) she had made 2 raids on this country and 14 'war cruises'.

<sup>1</sup> Oberleutnant Schütze.

<sup>2</sup> He had actually reached Sisteron, a long way south of the Swiss border.

Of the 11 airships that took part in this raid only 7 reached Germany safely: *L. 41* (Hauptmann Manger), *L. 46* (Kapitänleutnant Hollender), *L. 47* (Kapitänleutnant von Freudenreich), *L. 52* (Oberleutnant Freimel), *L. 53* (Kapitänleutnant Proelss), *L. 54* (Kapitänleutnant Freiherr von Buttlar). *L. 55* (Oberleutnant Flemming) succeeded in reaching Germany, but was wrecked on landing.

The fate of the four others was as follows: *L. 44* (Kapitänleutnant Stabbert) was shot down by anti-aircraft guns over France and fell to the ground at Chenevières (between Metz and Strassburg)—all on board her perished. *L. 45* (Kapitänleutnant Kölle), as already described, made a forced landing on the eastern side of the valley of the Bueche. She was wrecked and her remains set alight and the crew were captured. *L. 49* (Kapitänleutnant Gayer) was attacked by the pilots of 5 French aircraft and forced by them to land in the valley of Apance near Bourbonne.

*L. 50* (Kapitänleutnant Schwander) had a remarkable adventure. On her return journey she crossed over France and went on to Dixmude and thence over the German sector by Valenciennes and Guise, without her commander apparently being aware of the fact. *L. 50* then crossed the French lines in the Champagne district, but, owing to the thick fog, Schwander did not know his whereabouts. The officers and crew of this ship were rendered helpless by the cold and the lack of oxygen, for a German account<sup>1</sup> states:

'They had been in the air more than 24 hours, 10 of which had been spent in maximum altitudes where they had to resort to oxygen to sustain life. Even with oxygen, the extreme cold and nerve strain reduced some of the crew to a state of helplessness. When the engineers in the motor gondolas had exhausted their oxygen, they simply lay down and the motors rattled on, unattended. The officers and helmsmen in the control car had done their best to economize on oxygen, taking turns at the wheels, which they were barely able to turn for sheer want of breath. When one of the crew happened to remember a reserve flask of oxygen stored in the corridor of the ship, there was none strong enough to climb up the short ladder from the control car to get it. Too exhausted to move or eat, helplessly cruising in a frozen void, with the engines running at speeds ordered by Kapitänleutnant Schwander 6 hours before, when he hoped to make Switzerland.'

A little later, when over Épinal, *L. 50* was attacked by the pilots of French aeroplanes, but escaped. Some time afterwards Schwander saw *L. 49* on the ground (after her forced landing) and, believing himself in friendly territory, prepared to land.

<sup>1</sup> *The Zeppelins*, p. 252.

He realized his mistake and ascended rapidly to 10,000 feet, but almost immediately brought his airship down again, nearly to the ground, with the result that the impact knocked off the control car and the rear engine gondola with 16 men in them. The rest of the airship, with 4 men aboard, shot up into the air, was repeatedly attacked by the pilots of French aeroplanes, but without success, and then disappeared over the Mediterranean and was never seen again.

So ended the last big raid made by airships during the War, and this, because of the weather, was a catastrophe for the enemy. They lost nearly half of their force, and, as already related, achieved virtually nothing. In defence of the airship, it must be said that had Strasser known the weather conditions the raid would never have been made.

At Great Yarmouth air station the weather was so bad during the rest of October that but little flying was done. This bad weather was the cause of the death of a pilot, for on the 28th Flight Sub-Lieutenant P. G. Shepherd was lost in a Short seaplane while on a patrol to 'Brown Ridge' (about 90 miles east of Great Yarmouth), and was never seen again, despite an extensive search by numbers of aircraft and a large fleet of trawlers, drifters, and motor launches.

On the 29th, while the H. 12, N. 8660 (carrying a crew of four—Flight Lieutenant Leckie, Flight Sub-Lieutenant Bolton, Chief Petty Officer Whatling, and Air Mechanic Walker)—was engaged in searching for Shepherd, Leckie sighted and attacked an enemy submarine. In his own words:

'About 10.25 p.m., when about 10 miles east-by-south of Smith's Knoll, C.P.O. Whatling observed the conning tower of a submarine to break the surface of the sea immediately beneath us. I immediately put the machine about to bomb her. The submarine had by this time, however, submerged and no surface disturbance could be seen. I at once reported the incident by means of Aldis lamp to H.M.S. *Dryad*, which was steaming north about one and a half miles north-by-east of above-mentioned position.

'At 12.15 p.m. I sighted a periscope about 2 miles distant on my starboard bow. I at once increased speed of machine to 90 knots and came down to 500 feet. The periscope was only visible for about 15 seconds when submarine again submerged. Flight Sub-Lieutenant Bolton released two 100-lb. bombs with 2½ seconds delay fuses over the spot where the periscope was last seen, but no visible results were obtained.'

On November 5 a new commanding officer, Wing Commander C. R. Samson, D.S.O., was appointed to command the air

station, for Squadron Commander D. A. Oliver, D.S.O., was transferred to the staff of Admiral Sir Cecil Burney, G.C.B., G.C.M.G.

Part of the career of the Wing Commander has been given already in this narrative, but to this may be added the information that at the outbreak of hostilities he commanded the original No. 1 Wing in Flanders and fought many actions with the Royal Naval Armoured Cars.<sup>1</sup> Later he saw service in the Gallipoli campaign, commanding the aircraft-carrier *Ben-my-chree*. At the conclusion of this particular campaign he commanded another carrier, the *Raven II*, which operated in the Indian Ocean. Before being appointed to the command of Great Yarmouth air station he was on the staff of the Air Department at the Admiralty. He was promoted to the rank of Wing Captain shortly after coming to Great Yarmouth.

During November, despite the weather being bad, patrols were made regularly; nearly 7,000 miles were flown on anti-submarine patrols alone, and Wing Captain Samson instituted several additional anti-hostile aircraft patrols.

On November 17, for the last time during the War, British and German capital ships were in action.<sup>2</sup> That morning a striking force composed of the First Cruiser Squadron, the First and Sixth Light Cruiser Squadrons, the whole under Vice-Admiral T. D. W. Napier, penetrated into the Helgoland Bight in the hope that they would meet some of the enemy cruiser forces which were escorting their mine-sweeping flotillas. Our cruiser forces were supported by the First Battle Squadron and the First Battle Cruiser Squadron. Early in the morning our forces sighted some enemy cruisers, mine-sweepers, and auxiliaries, and an indecisive action was then fought. The enemy, under the command of Admiral von Reuter, made skilful use of smoke screens, and escaped with little loss. The action was a very disappointing one. Fog prevented our heavier ships coming into action, and very serious faults were discovered in the design of the heavy cruisers, the *Courageous* and *Glorious*. These ships had half their armament astern, and they were obliged to alter course continually in order to bring their heavy guns to bear. Even then, the angle was so sharp that both of these ships inflicted serious damage upon their own superstructure.

<sup>1</sup> Vide *The War in the Air*, vol. i, pp. 371-87.

<sup>2</sup> For an account of this action vide a special article in *The Times*, November 17, 1927; *Germany's High Sea Fleet in the World War*, pp. 304-9; also *Battleships in Action*, vol. ii, pp. 207-8; and *Der Grosse Krieg*, vol. iv, p. 119.

The small part played by the personnel of Great Yarmouth air station during this operation may be seen from the following extract taken from an officer's diary:

'Found the station full of rumours of bombardments and invasion at dawn. Consequently everybody was exceedingly busy all night in teeing-up and running all machines and preparing for any eventuality. Dawn finally arrived and found all the machines ready for their many duties. Unfortunately, there was a thick fog, so all flying was in abeyance. At about 10.30 a.m., the "resume normal conditions" signal came through, also the fog cleared. Having got everything ready, Wing Captain Samson thought it a pity not to profit by the occasion and carry out a practice evolution. So all machines and pilots were ordered to carry on. Every single pilot who could fly was thrust into the air.'

A German officer has been good enough to contribute the following note on the activities of their aircraft during the operations on that date:

'On November 17, English light cruiser forces penetrated into the Helgoland Bight. The escorting cruisers of our mine-sweeping flotilla should, according to orders, have taken machines on board, but this was not possible, as on the previous day there was a thick fog. On the 17th also, the visibility in the Helgoland Bight was too bad, so that the patrols of the air stations did not leave before 9.0 a.m. Helgoland air station patrolled to the north-west and maintained contact with the enemy, and attacked an armoured cruiser with bombs, making an unmistakable hit at 11.25 hours. An enemy armoured cruiser was seen in flames at 10.30 hours by two machines. At 11.45 hours an enemy torpedo-boat was seen being towed by other boats. On the return, one of our machines made a forced landing, because of the fog, in the Wangerooger Channel. She alighted safely but capsized in the breakers caused by the ground swell. The pilot was drowned.'

December opened with gales and snow, but towards the end of the first week the weather moderated and it was possible to resume patrols. On the 8th Flight Lieutenant Cross, with Air Mechanic Raymond as his wireless telegraphic observer, while flying in a Short seaplane, thought they saw the periscope wake of a hostile submarine to the north of Smith's Knoll pillar buoy. They bombed the spot 'where the last wake was seen', but no oil or wreckage appeared. They alighted afterwards near some trawlers and told them of the attack, and then flew back to the air station.

During the month Zeppelin airships were active over the North Sea, and in consequence of certain intelligence reports received

<sup>1</sup> A mate, Sander by name.

on the 12th a flying-boat and a D.H. 4 left the station for the Terschelling area. The former craft was the H. 12, N. 8666, piloted by Flight Sub-Lieutenant S. J. Fetherston with Squadron Commander Nicholl in command. The engineer was Air Mechanic Chapman, and the wireless telegraphist Petty Officer Thompson. The pilot of the D.H. 4 was Flight Lieutenant Fane and Observer Lieutenant E. B. C. Betts was the observer. The operation was similar to the now famous one of September 5, and it ended nearly as disastrously, for, when over Terschelling, the D.H. 4 had engine trouble and had to turn back, and 'just managed to get into Covehithe aerodrome with 15 feet to spare'. The fog was so thick on the return journey that, when they struck the coast at Covehithe, Fetherston could see neither sky, sea, nor land. Nicholl therefore stood up in the forward cockpit from where he could see the line of the surf on the beach, and by signs gave Fetherston the right course to steer.

It is a fitting commentary on their courage to remember that both Nicholl and Thompson were in 8666 on those three terrible days, September 5 to 8.

So ended the year 1917 for Great Yarmouth air station—a year marked by considerable progress in the equipment of the station and the results achieved by its personnel. The number of officers had increased to 56 with 6 warrant officers, and among these the following joined the station towards the close of the year: Squadron Commander A. Leaman-Berry, Flight Commander A. S. Maskell, Flight Lieutenants B. C. H. Cross, J. B. Cussen, and Flight Sub-Lieutenants S. Anderson, L. C. Beaver, A. P. Bell, J. N. Bicknall, V. J. Budd, G. R. Burge, B. B. Caswell, W. H. Comstock, S. J. C. Ellis, J. C. Grant, G. F. Hodson, W. J. Daddo-Langlois, E. Morris, E. A. Mossop, F. G. Newall, R. C. Packe, A. H. Paull, H. F. Potter, A. L. Rimer, L. Stocks, and Assistant-Paymaster A. H. Tarper, R.N.R. Four 'specialist' officers of the Royal Naval Volunteer Reserve had also joined: Lieutenants E. H. Carmichael, C. W. McCann, F. J. R. Macfadyen, and W. Pollock, and, in addition to these, four warrant officers, by name H. D. Oliver, J. W. Rose, E. F. Thorpe, and F. H. Whitmore, D.S.C.

## XVI

### THE COMING OF THE ROYAL AIR FORCE AND THE TECHNICAL DEVELOPMENT OF THE ROYAL NAVAL AIR SERVICE DURING THE YEAR 1917

THE principal event which occurred during the opening months of 1917 directly concerned with the internal policy of the two Air Services was the establishment, on February 6 (by an Order in Council), of the new and second Air Board, a course which, it may be remembered, the Government had decided upon during the November of the previous year.

This new Air Board differed from the old one in that, in addition to the President (the Right Honourable Viscount Cowdray of Midhurst), it consisted of a Parliamentary Secretary (Major J. L. Baird, C.M.G., D.S.O., M.P.), the Director of Air Services as the Fifth Sea Lord (Commodore Godfrey Paine, C.B., M.V.O., R.N.), the Director-General of Military Aeronautics (Lieutenant-General Sir David Henderson, K.C.B.), the Controller of Aeronautical Supplies (Mr. William Weir), and the Controller of the Petrol Engine Department (Mr. Percy Martin), the last two gentlemen being officers of the Ministry of Munitions. In addition, a technical department of the Air Board was formed to deal with all matters of research, invention, and design connected with aircraft, and a committee on civil aviation, with Viscount Northcliffe as its chairman, was established.

In order to promote a *liaison* between the two flying Services, it was decided that the majority of their administrative and technical staffs should be housed in one building, together with certain of the officials from the Ministry of Munitions. With this object in view, the Hotel Cecil, in the Strand, London, was requisitioned, and into it the staff of the Air Board was transferred from its quarters in Carlton House Terrace, together with the staffs of the Royal Naval Air Service (from the Admiralty) and the Royal Flying Corps from Adastral House—which was formerly De Kayser's Hotel.

To turn to the functions of the Air Board and the distribution of authority between it, the Admiralty, War Office, and Ministry of Munitions. The Board was to be free to discuss matters of policy and to make recommendations to the Admiralty and War

Office, and these departments were required to concert their own policies in consultation with the Air Board. The Board approved programmes of construction (which were prepared by the staffs of the two flying Services), and its approval was required for the provision of all aeronautical material. In practice, however, specific approval was given only for aeroplanes, seaplanes, flying-boats, and engines; the Admiralty alone was responsible for airships. The Board was dependent on the Admiralty and War Office for non-technical stores, supplies, and armament. In short, the Board was a self-contained aeronautical supply Ministry, and served as the nucleus of a full administrative department in that the head-quarters' executive staffs of the two flying Services were housed in the same building, and this tended to make the ultimate fusion more natural and less difficult than it would have been otherwise.

While the powers of the Board were effective where the supply of aircraft was concerned, it was in the matter of control of the higher policy of air offence and defence that it felt the inadequacy of its administrative powers. The main reason why the Board, while successful in its task of supplying material, was not equally successful in its further (and infinitely more difficult) task of co-ordinating and guiding policy with regard to air offence and defence was that, having no professional staff of its own, it had to depend for its advice on naval and military officers who, holding allegiance primarily to their own Services, were not, and could not be expected to be, in a position of independence. It was because questions of policy could not be handled by the Air Board that the Government decided to transform it into a full Air Ministry, and with it to amalgamate the two flying Services. Nevertheless, despite the statements of ill-informed critics, the period during which the Cowdray Air Board held sway was a notable one, not only by reason of what it accomplished in the way of organizing the air power of this country on the side of material, but because it paved the way for the subsequent organization on the side of general administration and personnel.

During the lifetime of the Board the agitation, both professional and lay, in favour of a single air Service grew in intensity. It was recognized that a combined Service under an Air Ministry might have been an ideal arrangement, but the time seemed inopportune for a reorganization which would have been bound to cause a certain dislocation in the Air Services, because these were becoming daily more vital to both naval and military operations.

The opposition of the Admiralty to such a scheme was deep-rooted because of the essential differences between the kind of aircraft required and its use in the two Services, and made an easy settlement of the difficult problems involved unlikely.

The enemy, however, by their own actions, were to make a unified Service essential and possible. On June 13 (1917) 19 Gotha bombing machines raided London in broad daylight. Some 4 tons of bombs were dropped on the City, as a result of which 162 people were killed and 432 injured—the heaviest casualties ever inflicted in any one air raid. The enemy machines suffered no loss. This caused considerable alarm in Government circles, and No. 56 Squadron, R.F.C., was brought from France to protect London. The raid also aroused general feelings of exasperation and bitterness, which were intensified by a further enemy daylight raid over London on July 7.

The most important result of these two raids was that they served to break the backbone of departmental opposition to the reorganization and amalgamation of the Air Services. The Cabinet, realizing the seriousness of the situation, hurriedly convened a meeting of aeronautical experts a few hours after the raid of July 7, and a committee was at once formed under the Prime Minister's nominal, but Lieutenant-General Smuts's actual, chairmanship, to consider the whole question of air defence and administration.

While the Committee was engaged in its investigations, the Air Board had come to the conclusion that the production of aircraft was now so satisfactory that the needs of the Navy and Army would be satisfied shortly, and, moreover, that there would be then a disposable surplus of machines. Lord Cowdray accordingly addressed a letter, on July 28, to Lieutenant-General Smuts, 'setting forth his view that the Air Board should be turned into a permanent Ministry, that it should have a War Staff to consider the best use to be made of aircraft not needed directly by the operations of the Army and the Navy, and that the surplus aircraft should be considered a distinct unit from the air contingent attached to the Expeditionary Force'.<sup>1</sup>

General Smuts's committee reported in a similar vein, with the result that on August 24 the Cabinet decided, firstly, to accept in principle the establishment of an Air Ministry, and, secondly, that a new committee under the chairmanship of General Smuts should meet at once to work out a scheme for giving effect to this

<sup>1</sup> The War Cabinet—Report for the Year 1917, p. 59.

decision. The result of these deliberations was that 'The Air Force (Constitutional) Bill, 1917', was introduced in the House of Commons on November 8. It was passed by both Houses and received the Royal Assent on November 29. In accordance with the terms of the Act an Air Ministry was sanctioned as a Department of State, and the two flying Services were amalgamated into one Service—The Royal Air Force—the Act to come into operation on April 1 of the financial year next ensuing.<sup>1</sup>

To turn now to the general technical development of the Royal Naval Air Service during the year 1917. The problems connected with the supply of aircraft and all its components and auxiliaries gave great anxiety throughout the year, for the demands upon the country's manufacturing sources were enormous.

At the beginning of the year the Royal Naval Air Service had 1,086 aeroplanes, 415 seaplanes, and 3,444 engines (not including those in airships), and was using 43 types of aeroplanes; but of these 15 were the same as those used by the Royal Flying Corps. Allowing for these, and taking those employed by the latter, the net number of types was 76. The number of seaplane types was 32. Thirty-nine types of engines were used by the Royal Naval Air Service and 30 by the Royal Flying Corps, the net number of different types being 57.

It was apparent that mass production could not be obtained on these lines, and a drastic reduction in the number of types was effected directly the Controller of Aeronautical Supplies (Sir William Weir) took over the matter of production. The policy adopted was to obtain as many as practicable of the types most readily procurable, so that in the future a general standardization policy could be undertaken without crippling seriously the growth of the establishment. By March 1 (1917) engine types had been reduced to 33, while the main types appearing on the new programme were about 20 in number. Aeroplane types were 39, about 30 of which appeared for production in quantities, in accordance with the new programme. Seaplane types had been reduced to 16. The experimental manufacture of aeroplanes was controlled by an order of the Ministry issued in March, so that no maker of aircraft was allowed to proceed with the manufacture of experimental types without an official permit. This injunction was extended a year later to the manufacture of air-

<sup>1</sup> For a detailed account of the events narrated in this chapter to this point vide *The Beginnings of Organized Air Power*, chapters vi to ix.

craft engines. By September 1917 the Supply Department was working on an engine programme of approximately 13 types, and on an aeroplane programme of 14 types, although many other types were still in production and requirements changed with such rapidity that absolute figures were difficult to give at any time. It had become, however, much more difficult for the Technical Department to secure the admission of a new type to the constructional programme, either of an aeroplane or of an engine, because the outstanding experience of the past 6 months had been the troubles and delays associated with the process of putting a new type into manufacture, particularly in the case of an engine which had been chosen for construction before it had been tested thoroughly under conditions it would have to satisfy when in actual service.

Directly the Ministry of Munitions became responsible for the supply of aircraft (March 1917) an interim programme of joint naval and military requirements was prepared for the four months March to June 1917. The provision of engines was the limiting factor in the fulfilment of this programme. The chief limiting factor in aeroplane output was the supply of materials, the quantities of timber, chemicals, and linen fabric required being very large. The supply of aeronautical general stores—machine-guns, synchronizing gears, and instruments—was also a difficult problem. The seaplane programme presented by the Admiralty, although small when compared with the aeroplane programme, nevertheless represented an increase quite comparable. The principal difficulty in arranging to satisfy the programme of requirements was the technical situation. Satisfactory types had not been developed, for the technical position was such that the selection of a small number of satisfactory types from those partially developed was almost impossible.

On the arrival of the summer months it was becoming evident that the capacity for construction of the already existing manufacturing concerns had reached its limit, and to meet the requirements of the aircraft programme development on new lines was needed. Sir William Weir decided to reverse the policy of distributing the work over a very large number of small producers, and instead to concentrate on large units. Experience in other branches of the Ministry of Munitions had shown that the most satisfactory producers of munitions were the big works. The tuition work involved in training a large number of small producers was overtaking the supply of available inspectors. Ques-

tions of works organization, assemblage space, finance, and allocation of material also pointed to the superiority of the larger units. It was proposed, therefore, at this period to arrange for a number of National Aircraft Factories, and in September it was decided to erect three such factories, each with a capacity of 200 medium-sized machines a month; but machines were not in production from these factories until 6 or 7 months later.

About the same time that the Ministry of Munitions assumed responsibility for aeronautical supply the United States of America declared war on Germany. America's entry into the War (April 6) had an adverse effect on British aeronautical supply for many months. The Government at Washington failed to appreciate the complexity of the problem of aviation supply and experience in Europe, and its natural desire to develop a policy of its own had a most disturbing effect on British contracts in America and on the supply of raw material, more especially of silver spruce, the only timber which is wholly satisfactory for aeroplane spars. Large orders placed by America in France threatened the completion of British contracts in that country, while both there and in Italy the facilities for aircraft production were neither fully nor efficiently utilized. The American programme was, in the light of British experience, obviously an over-estimate, and it was clear that Great Britain would have to rely entirely on her own efforts for the aerial programme of 1917-18.

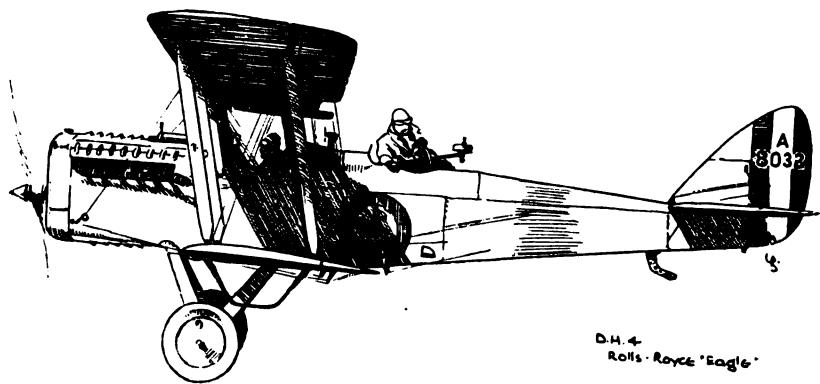
Despite all these difficulties the total output of aeroplanes, seaplanes, and flying-boats from home and foreign sources available for the two flying Services was 15,889, as compared with 7,087 in 1916; and in the case of engines the figures were 16,665 and 7,227 respectively.

To turn to a description of some of the machines that were issued to Great Yarmouth air station during 1917. Of the two-seater land machines the D.H. 4 was one of the most successful. This machine was built to the design of Captain Geoffrey de Havilland by the Aircraft Manufacturing Company, Limited, and was equipped in turn with the 200 b.h.p. Raf 3a, the 230 b.h.p. B.H.P., and the 370 b.h.p. Rolls Royce engines. With the first of these its speed at 10,000 feet was 118 miles an hour with a full load of 3,346 pounds, and with the second 134 miles an hour. The machine equipped with the Raf engine could reach, when fully loaded, its maximum ceiling of 10,000 feet in 14 minutes, whereas, when the Rolls Royce engine was installed, it could reach that height in 9 minutes; its maximum ceiling was about 24,000 feet.

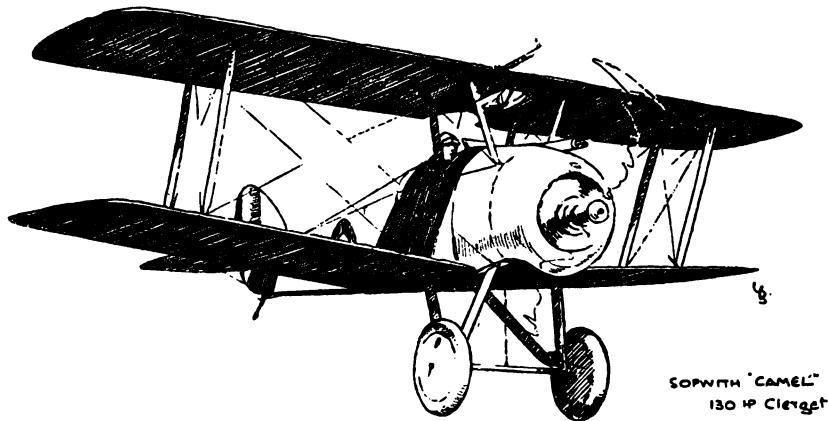
The Sopwith Camel—a single-seater fighter—came to the station during the summer months. Few aeroplanes did more to repulse German attempts at aerial supremacy than this machine. It derived its name from the hump which it carried on the forward top-side of its fuselage, by virtue of the fitting of two fixed, synchronized Vickers machine-guns. A good field of vision was obtained by seating the pilot fairly well forward, and also by the forward stagger of the planes. In place of the large transparent panels fitted into the middle of the top plane in the Sopwith Pup, that of the Camel was provided with a 'faired-off' slot. The remainder of the design followed the lines of the Pup pretty closely, but the Camel was the first fighter to be fitted with two synchronized machine-guns. Equipped with the 130 b.h.p. Clerget engine, this machine had a speed of about 105 miles an hour and a ceiling of about 18,000 feet. The Camel was unstable but easily controlled when the pilot had learned its peculiarities.

The float seaplane in general use on the air station was the '320' Short. In fact, little progress was made during 1917 with the design of float seaplanes; the Fairey Aviation Company produced the IIIc float seaplane (a machine of this type was not issued to Great Yarmouth air station until November 1918), which was a distinct improvement upon either of its predecessors. The three-float suspension system with wing-tip floats was employed for the undercarriage. The main planes, as opposed to all earlier types of Fairey seaplanes, were arranged to be of equal span for both the upper and lower planes. As with the Campania, the radiators for the cooling system were arranged on the sides of the fuselage, but were placed much farther aft, being in line with the rear of the pilot's seat, whereas those of the Campania lay alongside the engine. Various types of Sunbeam and Rolls Royce engines were installed in these seaplanes. It was, however, in the development of the design and in the building of flying-boats that the chief advance of the year took place. In this work Wing Commander John Porte and his staff at Felixstowe air station must be remembered always. Wing Commander Porte, though suffering from tuberculosis of the lungs, devoted all the energy of which he was capable to the successful production of flying-boats. Of him (he died in 1919 at the age of 36) the first official historian to the Royal Air Force, the late Sir Walter Raleigh, said: 'The shortest possible list of those who served the country in its hour of need would have to include his name.'

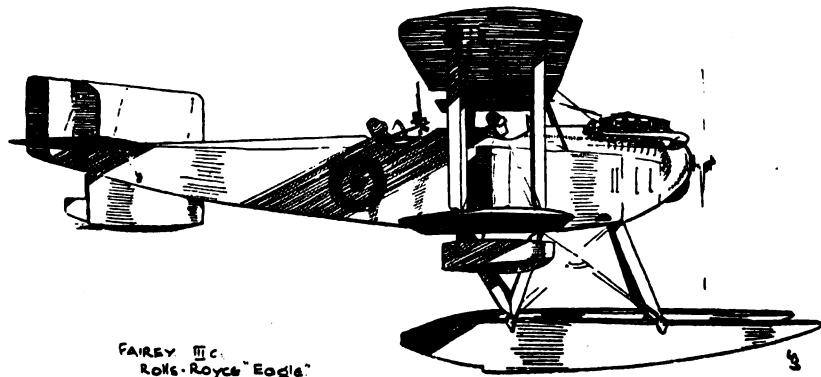
Some account has been given already of the development of the



D.H.4  
Rolls-Royce "Eagle"



SOPWITH "CAMEL"  
130 HP Clerget



FAIREY III.C.  
Rolls-Royce "Eagle."

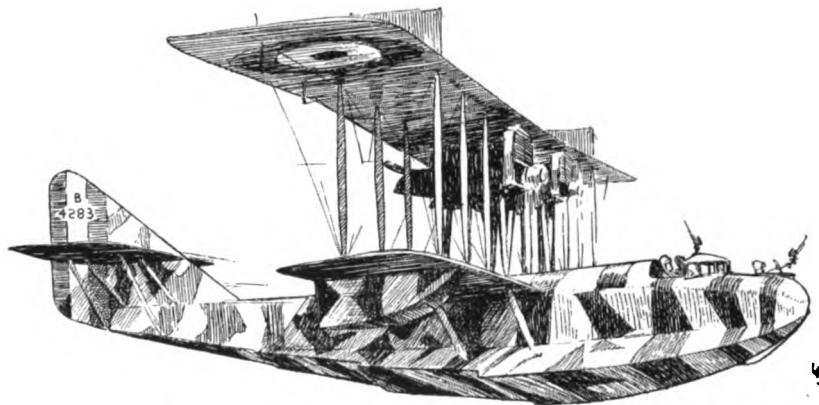
H. 12 type of flying-boat, and of its disadvantages. These drawbacks were surmounted largely by the development, under Wing Commander Porte, of the 'F' (Felixstowe) series of flying-boats. Of these the most famous was the F. 2a, which was designed and built in 1917. The hull of this boat was 'V'-shaped and curved from bow to stern, and the tail portion of the hull rose clear from the water when she floated at rest. This feature in her design served many useful purposes. Firstly, a pilot could alight with less fear of damage and in much rougher seas than was possible with the H. 12, because, with this particular type of hull, a 'tail down landing' could be made at a much lower speed. Secondly, the 'V'-shaped bottom facilitated 'taking off' in rougher waters, because it did not hammer the water while attaining flying speed to anything like the extent that obtained with the practically flat bottom of the H. 12.

In addition to the improvements effected in the flying capabilities, the 'cocking up' of the tail in the F. 2a made it possible to add two Lewis machine-guns at the tail of the boat, these being housed normally inside the hull on the port and starboard sides. Sliding doors, on the sides of the hull just aft of the main planes, uncovered ports, so that the guns could be swung outboard, thus enabling wide arcs of fire (which met at a point about 20 feet astern) to be obtained. These guns made an attack from under the tail dangerous tactics for an enemy machine to adopt, while if an F. 2a were attacked from above she was protected by a Lewis gun mounted on the top of the hull in the after cockpit. There was, unfortunately, still a 'blind' area immediately behind the tail plane, and this was found always to offer opportunity for the enemy to attack from astern.

The F. 2a was similar in over-all dimensions to the H. 12, the hull being 45 feet distant from the bow to the back of the rudder, and the span of the main planes was 98 feet. She was fitted with two Rolls Royce engines, each of 350 b.h.p., and was capable of a maximum speed of 85 to 90 knots. When carrying 585 lb. of military equipment she had a speed of 83 knots at 2,000 feet, 70 knots at 10,000 feet, climbed 2,000 feet in under 4 minutes, and 6,500 feet in under 17 minutes, had a ceiling of 9,500 feet, and an air endurance of 6 hours at 1,000 feet. She carried 250 gallons of petrol, sufficient for a cruise of about 8 hours' duration at 65 knots, and this was her cruising speed. The armament consisted of 6 Lewis machine-guns, for, in addition to the 3 after guns already mentioned, twin guns were mounted on a Scarff

Ring in the forward cockpit, and one gun was superimposed on the cabin and manned by the second pilot. In addition to this armament she was equipped with bomb racks on the under side of the main plane (close up to the hull), her normal equipment being two 230-lb. bombs, and for anti-submarine work these were of the depth-charge type, that is to say, the fuses were set to explode under water.

In the branches of engine, armament, and auxiliary production considerable development was made during 1917. The 200 b.h.p. B.H.P. engine appeared early in the year. The initials



F 2 A.  
2 - Rolls-Royce Eagle -

B.H.P. stood for Beardmore—Halford—Pullinger, from the names of its designers; it was built by the Arrol Johnston Company, Limited, of Dumfries. The Siddeley Puma (developing 230 b.h.p.) was evolved from this engine. The Sunbeam Arab engine was run on trial towards the end of 1916, but was not in production until the end of 1917. The A.B.C. Dragonfly (built by A.B.C. Motors, Limited) was under test in September 1917, and was ordered in large quantities in the spring of the next year, but delay in production prevented it from being used in service during the War.

The engines in general use in the naval squadrons during 1917 and 1918 were the 110 b.h.p. Le Rhône and the 110 and 130 b.h.p. rotaries, the 150 b.h.p. Hispano-Suiza, the 230 b.h.p. B.H.P., various Rolls Royce engines, but particularly the 375 b.h.p. 'Eagle VIII', the Sunbeam engine of 260 and 320 b.h.p., the 400 b.h.p. America 'Liberty' engine, and the 230 b.h.p. Bentley rotary engine. The latter engine weighed 2.165 pounds

per b.h.p., as against the 3·2 pounds for the 80 b.h.p. Gnome engine of 1914, a reduction in weight of 30 per cent.

It may be said that, at the time of the Armistice, many new and interesting engines were in various stages of development. The air-cooled radial engine (which was represented in 1914 by the Anzani and Salmson) had fallen out of favour during hostilities on account of difficulties experienced with lubrication, but, at the time of the Armistice, the A.B.C. Dragonfly—a 9-cylinder radial engine of 230 b.h.p. weighing 2·165 pounds per b.h.p. (the same as the Bentley rotary engine)—and the 9-cylinder radial Cosmos Jupiter engine of 430 b.h.p. weighing as little as 1·47 pound per b.h.p., were in production.

The Rolls Royce Condor engine of 600 b.h.p., and the Napier Lion of 450 b.h.p. and the 500 b.h.p. Atlantic Puma (Pacific), would all have been fitted into machines had the War lasted a little longer.

The supply of machine-guns was sufficiently adequate for all active service machines to be equipped, and there were, in addition, sufficient supplies of Constantinesco synchronizing gears. In May there came as a development from the 'C.C.' gear, type 'B', an arrangement comprising one reservoir, one generator, and a main pipe-line, leading to a tee-joint, and so to two trigger motors. This was used for the twin-gun installation on the Le Rhône-engined Camels. About the same period the design of the type 'C' gear was developed. The advantage of this gear was that, except during the actual firing of the gun, the whole of the gear was at rest. Both of these types were fitted to machines and gave excellent performance. Damage to airscrews during fire became a rare occurrence—only about one hit for every 25,000 rounds fired. An idea of the extent to which the Constantinesco gears were used can be obtained from the fact that approximately 6,000 sets were issued during the period March to December 1917. In October 1917 arrangements were made to replace the Sopwith-Kauper interrupter gears by the 'C' type 'C.C.' gear, in order to standardize one type for all machines. The Hazelton mechanical interrupter gear was developed during this year, but never came into general use.

At first the ordinary ground pattern web belt was used for loading the cartridges in the Vickers machine-gun. The full belt was contained in an ammunition box, and arrangements were made to wind off the empty belt as it left the gun on to a drum rotated by 'shock absorber'. This system proved very un-

satisfactory. Imitating the method used originally by the Austrians, a form of disintegrating belt was then designed. With this arrangement the links left the gun separately and fell down a chute, dropping clear of the machine. In the case of the Lewis gun the empty cartridges fell into a canvas bag which was clamped to the side of the gun. The use of the two Vickers guns side by side in a machine made it very desirable that, in some cases, the gun should be capable of being fed from the left-hand side, and a left-hand feed-block, which was instantly interchangeable with the right-hand feed-block, was designed therefor, constructed, and issued for use. Another improvement made to the Vickers gun was the fitting of the Hazelton speeding-up conversion set. This device increased the rate of fire of the gun to about 1,000 rounds a minute.

The Royal Flying Corps sight-vane, more properly known as the Norman vane sight, was developed during this year, and was the standard one in use with the Lewis gun at the time of the Armistice. It comprised a bead and a vane mounted on each side of a central rotating pillar, and connected by arms which allowed of a reciprocating movement. The base of the pillar was fixed on a mounting fitted to the fore-end of the gun barrel. The sight was used in conjunction with a ring, and the distance between the bead pillar and the central pillar was arranged, with relation to the distance between the central pillar and the ring, in such a way as to make these distances proportional to the two forces acting on a bullet fired from a movable gun, i.e. the force due to the momentum and the force due to the propellant. Thus allowance was made for 'own' speed. The vane was acted on by the slipstream, so that the axis of the sight was always parallel to the line of the flight of the machine, no matter how the gun was pointed. In using the sight the bead was alined on the centre of the ring, and the target was then 'placed' in the ring.

In some instances the ring was mounted in a telescope of unit magnification, one of the best examples of which was the Aldis sight. Within the tube was a screen carrying a large circle and a smaller concentric ring together with twelve radial lines. The principle was the same as for the ring sight, but by virtue of the arrangement of lenses it was not necessary for the gunner to aline a back-sight and fore-sight, or to maintain an exact sight base, for as long as both circles were visible, the position of the eye did not matter, the ring always being seen with the centre on the object at which the tube was pointing. With this sight

it was only necessary to place the enemy machine in the proper position on the ring to ensure the correct aim. Special ring, bead, and Norman sights were illuminated successfully for night-flying. At the time when the Armistice was signed promising results were being obtained on the Jenkin day and night sight, a somewhat similar device to the Aldis unit magnification sight.

The year 1917 was not marked by great development in the design and construction of bombs, although experimental ones up to 1,800 lb. in weight were built for carrying in Handley Page machines; the supply, however, of bombs was much larger than in the previous year.

The year 1917 saw marked improvement in the mechanical equipment of all aircraft, especially in the matter of electrical installation, and by the Armistice practically all machines were equipped with one or more wind-driven generators which supplied energy for such diverse purposes as wireless telegraphy, electric lighting, electric heating for machine-guns, and clothing and various other devices.

## XVII

### THE ACTIVITIES DURING 1917 OF THE GERMAN AIR STATIONS OPPOSED TO GREAT YARMOUTH AIR STATION

THE year 1917 saw a considerable expansion in the Imperial German Naval Air Service, both in lighter and in heavier-than-air craft.

The work of the seaplane section during this year has been summarized, for the purpose of this narrative, by one of its most experienced officers (Oberleutnant W. von Gronau<sup>1</sup>), who states that:

'In the year 1917, the war in the North Sea underwent a considerable change, because of the attempts made by the English to block the Helgoland Bight with a belt of mines, while the German fleet was endeavouring to keep some mine-free passages open to the west, north-west, and north for their naval forces, especially the U-boats. It was, therefore, of great importance to arrange a supervision of the outer belt of mines which would leave no gaps, and at the same time, to guarantee that the work of the mine-sweeping flotillas should be free from surprise attacks by hostile craft. Because of this, the reconnaissance areas for individual air stations were divided into 9 sectors, a step which led to the simplifying of staff work and the handling of reports. Reconnaissance and the protection of the mine-sweeping flotillas were considered the most important tasks until, in a few daring attacks, the first English Curtiss flying-boats reached the Island of Borkum, so causing uneasiness to the air station and the naval staff.

'As these attacks were a surprise, and were made generally with a large number of machines, which were comparatively immune against machine-gun fire, defence against them became a difficult task, especially as, in order to prevent, as far as possible, their approach, it was necessary for us to patrol in the neighbourhood of Terschelling all day long when the weather was good. Also, as the fighting crew of the Curtiss flying-boat was large, our patrols had to be of equal strength. This task could not be performed with the reconnaissance machines used hitherto, as, for example, the existing single-seater fighters (which were intended only for local defence) which could not float at all (if they were forced to alight) and had only a very limited radius of action—namely 2½ hours' flight duration.

'Two new types of naval aircraft were developed therefore:

'1. The original torpedo-carrying machine, which was provided with a removable petrol tank instead of a torpedo, thus giving her an endurance

<sup>1</sup> At this period this officer was First Lieutenant to Fregattenkapitän Fritz Brehmer, the Commander of 'The North Sea Flying Division'.

of 10 hours, with the result that she could patrol for about 5 hours to a point 100 nautical miles west of Borkum, while a continuous watch was possible by these machines.

'2. Two-seater monoplane fighters (similar to those issued in the first place to Zeebrugge air station) were stationed also at the air stations at Norderney and Borkum. These machines flew usually in flights of three and had, as leader, a Friedrichshafen scout machine which would transmit wireless orders to them on the way. This machine was deputed also to save the occupants in bad weather, should any aircraft be forced to alight and be wrecked in so doing, as the two-seater fighters could only float for a short time.

'The first of these types did not stand up to the onerous conditions, especially the long duration of the patrol, and because of the defective construction of the engines, they had many breakdowns, with the result that considerable losses were experienced. The Brandenburg machines, on the other hand, behaved very well and fulfilled satisfactorily their task of preventing Curtiss flying-boats from penetrating into the Helgoland Bight, and, when they did, making them regret such attempts.

'In the meantime, reconnaissance was being made more and more difficult for our airships, because of the appearance of English fighters which were either brought to the spot by aircraft-carriers or flew over from air stations on the English coast.

'Furthermore, the activities of the English mine-layers increased continually, and consequently the duties of the mine-sweeping flotilla led it farther and farther from its base, with the result that it was found necessary to increase the strength of the protecting aircraft flights. This, in turn, led to a considerable enlargement of all air stations, and so it became necessary to divide the duties of Borkum and Norderney in such a way that Borkum chiefly practised and undertook the duties of fighting, while to Norderney was delegated the work of reconnaissance and the protection of the mine-sweeping flotilla. The stations were reinforced by the addition of the aircraft-carriers *Answald* and the *Santa Elena* and the small cruiser *Stuttgart* was also altered into an aircraft-carrier. . . .

'In the year 1917, the Friedrichshafen machine was equipped with a 200 b.h.p. Benz engine and fitted with two machine-guns. The wireless telegraphic apparatus which, until now, had been able only to transmit messages, was now arranged to receive them also.

'For the defence of the air stations themselves 150 b.h.p. single-seaters—Rumpler, Albatross, and Brandenburg—with one or two fixed machine-guns were added. Again, as already stated, we equipped two-seater Brandenburg monoplanes with one fixed and one movable machine-gun. Finally must be mentioned the long-distance reconnaissance machines of the Brandenburg and Gotha type, equipped with two 200 b.h.p. Benz engines. . . .

'The following special events of the year 1917 may be mentioned:

'On June 19, 3 monoplanes from the air station at Ostende shot down a Sopwith machine and a Short seaplane near the West Hinder light vessel.

'Curtiss flying-boats appeared off Zeebrugge for the first time at this period and in the Borkum patrol area, but they could not, at that time, be attacked successfully by our aircraft.

'On July 30, at 6.30 a.m., 9 enemy cruisers, 7 destroyers, and 2 smaller craft were sighted 20 miles off List, to the west. Owing to heavy gun-fire, our machines could not make any close observations.

'On August 21, at 6.45 a.m., machine No. 874, belonging to List air station, sighted enemy light cruisers 50 miles north of List, going full speed towards the north. At 8.45 a.m., the report came from airship *L. 23*: "Am pursued by enemy forces." As *L. 23* ceased to reply a large number of machines were sent out, one of which, at 4.30 p.m., found a great pool of oil and petrol 50 miles north-west of List, and, on alighting, fished up a blade of an airship propeller, charred at the boss.<sup>1</sup>

'On September 1, enemy forces were also observed from List, and they had a skirmish with German outpost ships. Bombs were dropped on them. No results could be observed. On September 19, List sighted 13 English destroyers, among them, 7 boats without superstructure, apparently motor boats.<sup>2</sup>

'On September 25, machine No. 1136 of Borkum air station had a fight with a Short seaplane near Terschelling. The combat had to be ended because of engine and machine-gun breakdown. A second machine of the same type was sighted to the westward. At about the same time, machine No. 1133, a few miles west of Vlieland, had a fight in the air with a Short seaplane, which was pursued to the west. Pursuit had to be abandoned for want of petrol. A little later, machine No. 1096 sighted a Curtiss flying-boat, which escaped by reason of its superior speed.<sup>3</sup>

'At 13.10 hours, on October 5, 8 machines of the Zeebrugge air station, led by Oberleutnant Christiansen, met a Curtiss flying-boat. It was shot down after a violent combat in the air. Two of the crew were killed, a

<sup>1</sup> This refers to the destruction of *L. 23* by Flight Sub-Lieutenant B. A. Smart in a Sopwith Pup flown from H.M.S. *Yarmouth*.

<sup>2</sup> These were probably C.M.B.'s, i.e. Coastal Motor-boats.

<sup>3</sup> This account refers to some operations conducted on that day in the Terschelling area by machines from the seaplane-carrier *Vindex*. Flight Commander B. D. Kilner (who, it may be remembered, had served previously at Great Yarmouth air station) left this ship in a Sopwith Pup to attack a Zeppelin airship. A few minutes later Flight Lieutenant E. G. Hopcroft left in a Short seaplane, for the purpose of picking him up in case of need. The Short seaplane pursued the Zeppelin airship, but could not make contact. Hopcroft missed Kilner and, when 30 miles to the north of Borkum, turned back to try and regain the *Vindex*. He sighted a convoy of 3 cargo ships, escorted by destroyers, one of which followed him for some distance. He then sighted 2 German seaplanes, which he prepared to attack, but which, according to his report, showed no inclination to engage. He flew on for some time until the petrol supply of his machine was exhausted, and he was forced to alight near the Haaks light vessel, after having been in the air for six hours. He was picked up by the crew of a Dutch fishing smack and towed into Dun Helder and interned. Flight Commander Kilner, a most gallant officer, was never seen again.

third was still alive in the sinking boat. It was impossible to save him, as he replied with violent machine-gun fire to every attempt of our machines to go down and rescue him.'

To turn now to the activities of the stations at Borkum, Norderney, and Zeebrugge.

Oberleutnant zur See Frege remained in command of Borkum air station until March 29, when, for the next two months, Oberleutnant d. R. Lilunfeld held the command. On May 26 his place was taken by Oberleutnant zur See von Tempsky who, in turn, was replaced on November 8 by Kapitänleutnant d. R. Bertram. This officer then commanded the station until the end of hostilities.

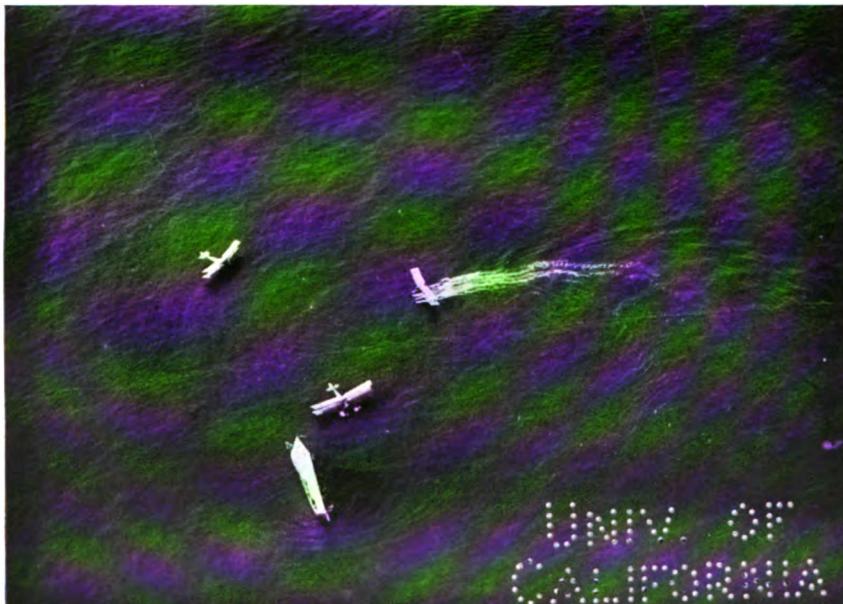
During the year considerable expansion took place in the station, and many new sheds were built, for there were generally about 20 machines there; with these, 1,513 flights were made—only 16 machines were lost. Apparently only one officer was killed during the year.

The following 'list of principal events' taken from a German official document gives some idea of the activities of Borkum air station during the year:

- '1917. 14. 1. From Wilhelmshaven Command a signal was sent expressing special recognition of the activity of pilots in the service of the forces on the high seas on 11. 1. 17.
- 25. 5. Dropped bombs on enemy submarine in 065 €. Result not ascertained, as submarine dived quickly.
- 26. 5. In 078 € bombed oil patch, apparently the place where a submarine had submerged.
- 14. 6. In 049 € bombed submarine as she dived.
- 15. 6. In 005 € dropped bombs on submarine as she dived. Result not visible.
- 17. 6. In 043 € an enemy high-speed scout. One machine met in 061 € an enemy flying-boat steering to the south-east and attacked it. After a lively exchange of shots during four separate attacks, in which the distance was decreased from 150 m. to 50 m., the enemy seaplane turned westward after 400 to 500 shots had been fired. At the same time our machine had to abandon the pursuit owing to the machine-gun jamming, and the pilot spent the time while the machine-gun trouble was being corrected in warning two torpedo-boats in the vicinity (which were escorting a German submarine into the Bight of Helgoland) of the presence of an enemy seaplane. During the fight our machine was hit three times in the fuselage. The crew were unhurt.



Zeebrugge seaplane station.



German seaplanes capturing a Dutch sailing barge, May 17, 1918.



1917. 18. 6. In 042 e bombed 2 submarines, result doubtful.
7. 8. Stopped the Dutch Tjalk *Mutatio* and searched it. Cargo of 3,000 kg. of glass from Rotterdam for Copenhagen. Papers in order.
21. 8. Sighted enemy submarine.
10. 9. Observed an unswept mine-field about 33 miles long.
11. 9. Dropped bombs where submarine had dived. Result not observed.
20. 9. Sighted drifting mine.
25. 9. Sighted enemy seaplane. Pursuit abandoned through lack of petrol. Fight with enemy biplanes; 1 Curtiss boat. Pursuit abandoned through lack of petrol and on account of machine-gun trouble.
22. 12. Sighted enemy submarine.'

Oberleutnant zur See Fredensburg remained in command of Norderney air station until September, when his place was taken by Korvettenkapitän Witte. From the beginning of 1916 to the beginning of 1917 this station was used solely for training purposes, but early in 1917 a scouting section was established there, to relieve the stations at Helgoland and Borkum for duty 'in the inner Bight of Helgoland'. Advanced training was given also to both pilots and observers. In July (1917) the duties of the stations at Borkum and Helgoland increased so much that part of the duty 'of scouting to the north-west' was delegated to the personnel at Norderney. As a result of this 'the bomb-dropping course had to be transferred to the Baltic, and at the end of April 1918 the flying school as well.'

In March some 'Giant G seaplanes' (*Grossaufklärungsflugzeug*) were sent to the station for:

'In the last year of the War the naval authorities ordained that aeroplanes should be used instead of airships for the purpose of observation patrols over the North Sea, as airships were unable to fly westwards during the day at a height favourable to observation, on account of the enemy's defensive patrols and the danger of incendiary ammunition to lighter-than-air craft. As a result of this, the construction of long-distance reconnaissance machines, carrying a larger crew and petrol for 8 or 10 hours, and also of large flying-boats and seaplanes with two or more engines, such as the G and R types, came more and more to the foreground.'<sup>1</sup>

Those 'G' machines sent to Norderney were intended for attacking the Grand Fleet while it was lying at its anchorage at Scapa Flow, but for various reasons this plan was not executed.

<sup>1</sup> *Die deutschen Luftstreitkräfte im Weltkriege*, p. 69. (English edition.)

Leutnant zur See Niemayer was in command of Zeebrugge air station at the beginning of 1917, but his place was taken a few weeks afterwards by Leutnant zur See Schüler. This officer held the command until September 15, when he was replaced by the redoubtable Oberleutnant d. R. Christiansen, who was the commanding officer of the station until the conclusion of hostilities.

As a German official document states, 'it would take too long to mention all the special achievements of this station', but it may be said that its pilots fought many actions during the year (but not with those from Great Yarmouth air station) and claimed to have shot down two English and three French flying-boats. They succeeded in destroying also two non-rigid airships of the Royal Naval Air Service—*C. 17* and *C. 27*. The torpedo-flight claimed to have torpedoed and sunk five merchant steamers during the year.

One of the officers of the Zeebrugge torpedo-flight<sup>1</sup> has contributed the following notes on some of the activities of the flight during this year:

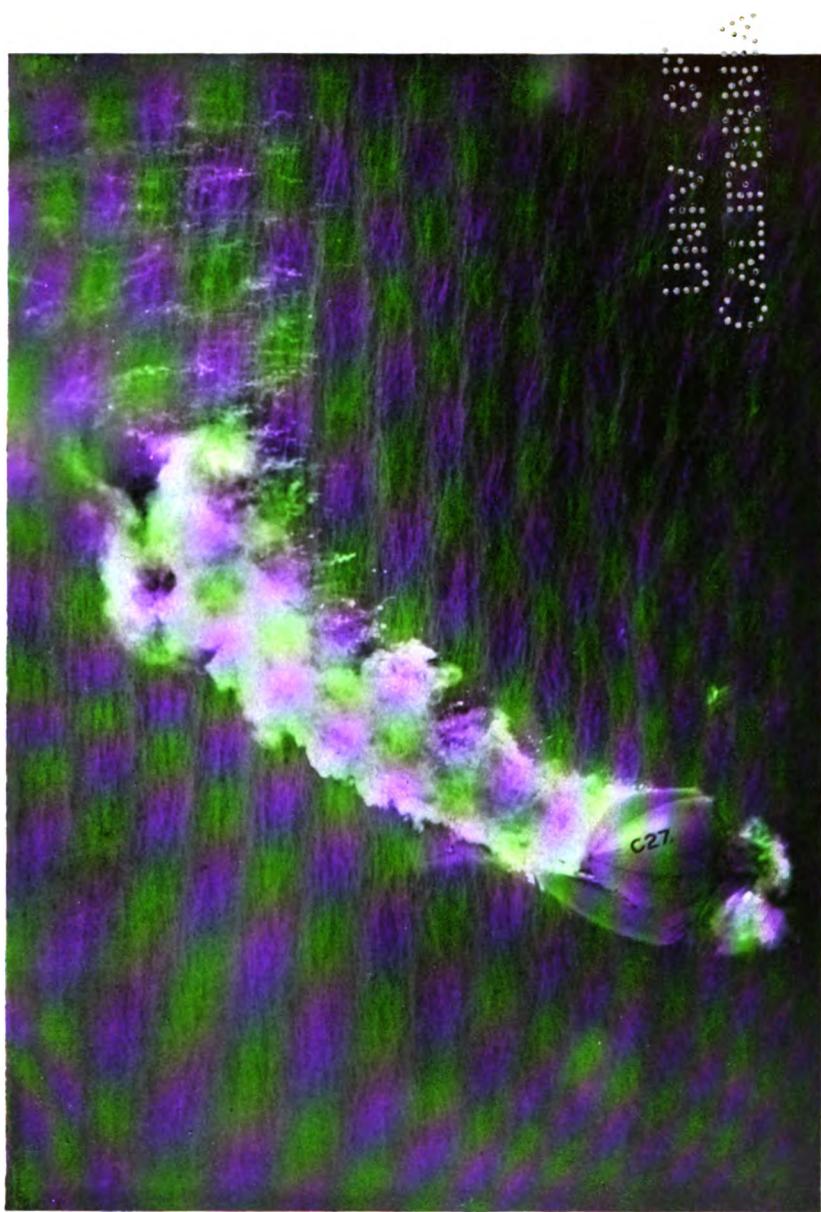
'The loss of the two torpedo-carriers on July 9, 1917,<sup>2</sup> was attributable entirely to the machines having to make their attack without sufficient protection from escorting fighters, with the result that one carrier got a direct hit on the engine, while the other (piloted by the writer) was broken up afterwards by the heavy seas, and I was taken prisoner while trying to start the engine up of my Gotha machine in a sea too rough for it, after picking up the crew of the torpedo-carrier which had been shot down.

'On this particular day, all four of the carriers which were ready were sent out in conditions which were favourable for making an attack—although there was a heavy swell. Because, however, all the torpedoes went to the bottom, it was decided not to risk any more machines and crews on an arm which was not yet ripe for active service. This was to be regretted particularly, as the machines could have interfered to a great extent with the English mercantile traffic in the Channel, if properly developed and equipped with suitable torpedoes.

'Because of the failure of the Torpedo-Carrier Flight No. 2 in Flanders, the crews lost interest in such attacks, and unfortunately those in high authority regarded torpedo-carriers as a very unsuitable weapon, with the result that nothing was done about the absolutely necessary development of this arm, so that, for the rest of the War, it hardly ever made its appearance. The machines were arranged also for dropping mines and bombs, the bombing attacks being chiefly directed on Dunkerque and Calais at night. Until July 1917 no attempts were made to lay mines with these machines in English waters, although no doubt this would also have given promise of success.'

<sup>1</sup> Oberleutnant H. Becker.

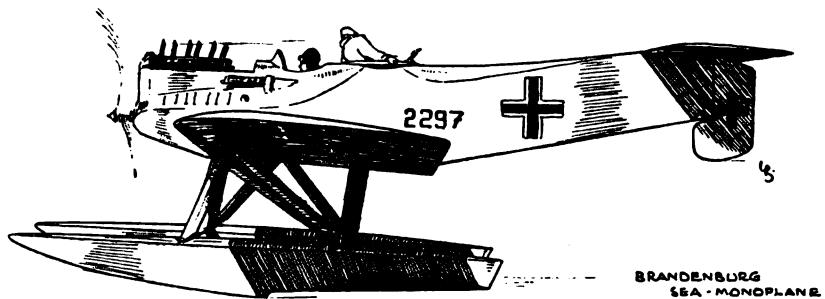
<sup>2</sup> Off Harwich.



THE COASTAL AIRSHIP C. 27 FALLING IN FLAMES, DECEMBER 12, 1917.  
Photographed from one of the attacking German machines.

1  
2  
3  
4  
5  
6  
7  
8  
9  
0

In the summer of 1917 the Imperial German Naval Air Service had about 887 seaplanes of various types. Of these, about 249 were single-seaters, of which the greatest number were Rumpler's and Albatross's. There were also some 36 Brandenburg biplanes (150 b.h.p. Benz engine) and about 250 miscellaneous types of Friedrichshafen machines which were without armament, or, at the most, in a few cases, equipped with one gun and could carry but a small number of bombs. The enemy had also some 65 twin-engined torpedo-carriers, chiefly of the Gotha type. During this year they abandoned the production of flying-boats, a type of craft with which they were never successful, and concentrated on the



design and construction of high-speed fighting seaplanes. Probably the most effective and efficient of such machines which they produced were the Brandenburgs, which owed their design to Herr Ernst Heinkel. In the spring of 1914 this gentleman received an offer (which he accepted) from the future *Hansa- und Brandenburgischen Flugzeugwerken A.G.* to act as chief designer and manager of the firm. One of the first machines he produced was the biplane type W.12. This machine had a small wing span and a very simple system of float stays. The design of this machine was commenced by Heinkel during the summer of 1916. At the time its building was followed with the greatest interest by the German Navy. It was delivered in 1917 and proved a great success. Fitted with a 150 b.h.p. Benz engine, it had a speed of 93 miles an hour (faster than any British seaplane) and could climb well. This machine was improved later and equipped with a larger engine, the 260 b.h.p. Benz. This biplane was followed then by the famous monoplane with twin floats that proved such a thorn in the sides of the machines operating from Great Yarmouth and Felixstowe air stations in the summer of 1918. Her designer brought out also in 1917 a small flying-boat (equipped

with an 80 b.h.p. Overursel engine) which was intended for carrying in submarines. The shortness of the time required for dismantling it was astonishing, for it was possible with but 4 men to dismantle the machine ready for stowing in *one and three-quarter minutes*, and to reassemble it again for flight in *two and three-quarter minutes*.

During 1917 great activity was shown by the submarine branch of the German Navy in its war against the allied merchant shipping, and as the Royal Naval Air Service played a considerable part in helping to defeat this menace, the next chapter will be devoted to giving some account of this particular campaign.

## XVIII

### THE GERMAN SUBMARINE CAMPAIGN AGAINST MERCANTILE SHIPPING

THE German submarine war against allied merchant shipping in the opening months of 1917 called for great efforts on the part of the Royal Naval Air Service, and, in particular, of the officers and men of Great Yarmouth air station. It is felt that some account should be given of this part of the campaign in order that anti-submarine operations, conducted by aircraft, may be understood.

As Mr. Winston Churchill has said since: 'Before the War what submarines could do, was one mystery. What they would be ordered to do, was another.'<sup>1</sup> One authority—the late Lord Fisher—believed, before the War, that in any naval conflict with Germany the submarine would be used against merchant vessels despite the provisions of the 'Law of Prizes'. In October 1913 Lord Fisher wrote a Memorandum on 'The Submarine and Commerce',<sup>2</sup> in which he declared that the German submarine commanders certainly would not hesitate to sink merchant ships which they could not bring into port as required by the laws of war.

A few months after the outbreak of hostilities the economic pressure of our blockade began to make itself felt, and in the early part of 1915 the German Government decided to retaliate by inaugurating a submarine campaign against the merchant shipping of the allied nations. In accordance with this decision it, on February 4, 1915, declared that:

'1. The waters around Great Britain and Ireland, including the whole of the English Channel, are herewith declared to be in the War Zone. From February 18, 1915, onward, every merchant ship met with in this War Zone will be destroyed, nor will it always be possible to obviate the danger with which the crews and passengers are hereby threatened.

'2. Neutral ships, too, will run a risk in the War Zone, for, in view of the misuse of neutral flags ordained by the British Government on January 31, and owing to the hazards of naval warfare, it may not always be possible to prevent the attacks meant for hostile ships from being directed against neutral ships.'<sup>3</sup>

<sup>1</sup> *The World Crisis*, p. 279.

<sup>2</sup> Part of this Memorandum is given in *Records*, pp. 183-5.

<sup>3</sup> Notice in the *Reichsanzeiger* (the Imperial Gazette) published on February 4, 1915, and signed by Admiral von Pohl.

The British Admiralty realized that it was 'confronted with the situation which Lord Fisher had foreseen in his Memorandum of 1913'.<sup>1</sup> But its anxiety was tempered by the knowledge that, at the time, the enemy had only some 25 submarines capable of blockading the United Kingdom, and that naturally not all these boats could be in operation at the same time—probably not more than 7 or 8 at the most. Knowing the limited number of torpedoes and explosives they could carry, it was felt that these boats could not hamper seriously the regular flow of merchant shipping, both allied and neutral, from and into our ports. Yet the position was realized as grave, and one that would need all our courage and skill to combat.

Although it is not possible (or necessary) within the limits of these pages to describe all the steps that were taken to combat the threat to our shipping through this means, it may be said that steps were taken to close the Straits of Dover by a net barrage, by the commissioning of a large number of armed drifters and a small number of decoy ships (afterwards called 'Q-boats') for hunting purposes; in short, as Mr. Winston Churchill has said, 'a close and fruitful union between the scientist, the inventor, and the submarine officer was established, the best brains of the Navy were concentrated on the problem, and no idea, technical or tactical, was spurned by the Admiralty Staff'.<sup>2</sup> These measures were fairly successful and several German submarines were sunk. The callous acts of some of their commanders excited the animosity of the allied and neutral nations—particularly the torpedoing, by *U.20*, of the *Lusitania* on May 7 (1915) with the loss of nearly 1,500 lives, and the firing (during the same year, August 21) on the crew of the S.S. *Ruel* when they had taken to their boats after their ship had been sunk.<sup>3</sup>

As explained already, aircraft played but little part in the hunting of enemy submarines during 1915, mainly owing to the fact that few of the seaplanes were capable of performing such an onerous duty.

On March 1, 1916, the 'extended' submarine campaign started. One month afterwards, the German Admiralty proposed, originally, to begin the 'unrestricted' campaign, but on March 24 the S.S. *Sussex* (a regular packet plying between Folkestone and Dieppe) was torpedoed without warning by *U.B. 29*, with the

<sup>1</sup> *The World Crisis*, 1915, p. 283.

<sup>2</sup> *Ibid.*, p. 291.

<sup>3</sup> *Vide Naval Operations*, vol. iii, p. 134.

result that many of the passengers in the *Sussex* lost their lives. Several of them were American citizens, and the United States Government informed the German Government that unless it 'should now and immediately declare and effect an abandonment of its present methods of submarine warfare against passenger and freight-carrying vessels, the Government of the United States of America can have no choice but to sever diplomatic relations with the German Empire altogether'. The immediate effect of this declaration was that the date of the opening of the 'unrestricted submarine warfare' was postponed until February 1, 1917, and that from May to October 1916 the campaign against merchant shipping was confined practically to the Mediterranean and to mine-laying by the submarines of the Flanders Bight. These operations inflicted considerable loss on allied shipping, and on October 6 (1916) the Imperial German Naval Staff instructed Admiral Scheer to resume 'restricted' submarine warfare in the North Sea.

During the year (1916) the number of German submarines available for active service increased from 47 in March to 93 in November, and with this increase the number of sinkings rose from a monthly average of 131,000 tons from April to September to 276,000 tons from September to February 1917. Mr. Churchill has summarized the position at the end of 1916, saying that:

'It was evident that the development of anti-submarine measures had not kept pace with the increasing intensity of the attack. The defensive measures instituted during 1915 had increased the number of armed merchantmen and auxiliary patrol vessels, but the problem of actually attacking and destroying U-boats was still in a rudimentary stage.'<sup>1</sup>

It may be said that the position with regard to the use of aircraft for anti-submarine operations at the end of 1916 had not altered materially from that which obtained in the previous year.

By February 1, 1917, the 'unrestricted' attack had begun in earnest. The number of German submarines was being increased continually, and the losses they inflicted on British, allied, and neutral vessels, which in January were 181, increased to 259 in February, to 325 in March, and to 423 in April; the corresponding figures in gross tonnage being 298,000 in January, 468,000 in February, 500,000 in March, and 849,000 in April. We know now that the German Naval Staff estimated that

<sup>1</sup> *The World Crisis, 1916-1918*, Part II, p. 360.

British shipping could be reduced at the rate of 600,000 tons a month, and, that if this rate could be maintained for 5 months, Great Britain would be forced to her knees. In April alone the total world tonnage lost reached 849,000 tons. The average monthly loss of British shipping during April, May, and June, from the action of German submarines, amounted to 409,300 tons, corresponding to a rate of nearly 5,000,000 tons a year. By the end of May, apart from vessels employed on naval and military services or essential trade in distant waters and those undergoing repairs, there was less than 6,000,000 tons of shipping available for all the supplies and trade of the United Kingdom.

This is not the place to describe how this menace was met and how the submarine campaign was defeated finally, but it may be said that, largely through the introduction of the convoy system, in the May of 1917, and the offensive use of the mine, the campaign was defeated definitely by the middle of 1918.

Before turning to the part played by aircraft in this campaign, and in order to be able to appreciate the work of enemy submarines, the limitations of this class of vessel should be understood. When travelling on the surface submarine boats derive their motive power from Diesel engines,<sup>1</sup> but when submerged their power is obtained from electric motors utilizing current from storage batteries. The batteries are charged by the motors, run as direct current generators, the power coming from the main Diesel engines, and this charging can only take place when the boat is on the surface. The underwater endurance of a submarine is limited by the capacity of the batteries, and also by the volume of air in the hull available for breathing purposes. When submerged the navigating officer has to depend for his visual knowledge of what is taking place on the surface of the sea and in the sky in his vicinity on the aid of the periscope, and aurally by means of hydrophones, although, without the latter, the 'beat' of propellers of surface vessels can be heard some distance away, depending on the bearing of the vessel and the state of the sea. The periscope must be used with extreme care, for the 'feather' of the aerated water which it causes (due to its motion) can be seen a mile away in clear weather from the bridge of a vessel and from the air a good deal farther, depending on the height of the aircraft and the atmospheric conditions. Most of the later

<sup>1</sup> The 'K' class of submarines in the Royal Navy are equipped with steam turbines in addition to Diesel engines.



ONE OF THE RESULTS OF 'UNRESTRICTED' SUBMARINE WARFARE.

22  
22  
22  
22

German submarines were fitted with two periscopes, and many with a third especially designed to enable the sky to be searched for aircraft. An experienced submarine commander never exposed his periscope for more than 5 to 10 seconds at a time, and then only about a foot of it, so that his pursuers had to be keen-eyed if they were to detect it.

In order to dive a submarine her commander fills the buoyancy tanks with sea-water, so that the boat has about a ton of positive buoyancy in hand. Then, when she either wishes to attack or is herself attacked, her Diesel engines are stopped and the electric motors started, and by depressing the bow and stern hydroplanes she will submerge rapidly. Due to the reaction on her inclined hydroplanes consequent upon her forward speed, German submarines, when travelling awash, could reach 'periscope depth' (that is, the depth at which the fully extended periscope just reaches to the surface—normally 45 feet) in 1½ minutes. The depth at which they cruised when submerged depended on the state of the sea. Normally, it was between 70 and 80 feet, but in bad weather they would submerge to 100 feet, for all submarines have a tendency to 'pump' in heavy seas, that is, they tend to move up and down in a vertical plane. When attacked, they would dive still deeper, and there are cases known when they submerged without injury (to their hulls) to 300 feet. The time they could travel submerged depended on their speed. Under maximum conditions this would be, at the most, not much longer than 2 hours, but, at a speed of 2 knots, German submarines could remain submerged for nearly 48 hours, and were known to have travelled 100 miles under these conditions.

In its campaign against allied merchant shipping the Imperial German Navy employed four types of submarine. (a) The U-type (U is the abbreviation of *Unterseeboot*, the German word for submarine boat); (b) the U.B. class, the coastal vessels; (c) the mine-layers, the U.C. boats; and (d) the 'Cruiser' submarines, including the converted mercantile class, the so-called *Deutschland* type.

The U-boats were those in general use. At first their surface displacement was 650 tons (*U. 19*). From *U. 40* onwards to *U. 80* this was increased to 700 tons, and later to 800 tons. The surface speed was raised also from 12 to 17 knots, and the underwater speed from 9 to 12 knots. The length of the later vessels was about 255 feet, with a beam of 22 feet. Their appearance was characterized by a long flush deck rising to the bows, a conning-tower amidships—usually with steps at different

levels—and a straight stern to which was affixed in the later boats a net-cutter. They carried at first only one 5-centimetre (1.97-inch) gun, but later this armament was increased, and in some cases they were fitted with 8.8-centimetre (3.45-inch) guns, one before and one abaft the conning-tower. They were equipped also with four to six torpedo tubes and could carry from 9 torpedoes in *U. 19* to 16 in *U. 90*. The calibre of these torpedoes was the standard—50 centimetres (20 inches)—with an explosive charge in the war head of tri-nitro-toluene weighing 200 kg. (440 lb.). The different vessels were capable of covering between 6,000 and 10,000 miles, according to their equipment, at a speed of 10 knots.

The U.B. boats were designed originally for use off the coast of Flanders. They were quite small, for the first had only single hulls with a displacement of 125 tons and a surface speed of 8.5 knots and 5.5 knots under water. Only four torpedoes were carried. Later the boats of this class were increased in size and further double-hulled boats of 500 tons displacement were built, with a corresponding higher speed and with an armament of 10.4 centimetre (4.1-inch) guns. The first U.B. boats had a rounded bow with a deck sloping down aft to the stern, which was awash, but in the later craft their bows were more like an ordinary ship with a slight overhang and a high conning-tower.

The original U. mine-layers were but 10 in number, namely, *U. 71* to *U. 80*. They had a displacement of 760 tons, a surface speed of 9.5 knots, and an underwater speed of 7.5 knots. These boats carried between 34 and 36 mines, but they were not armed with torpedoes. They were not very successful, and in the summer of 1918 a new series of larger boats was produced which were armed with one 15-centimetre (5.9-inch) gun forward and one smaller gun aft. The number of mines that could be carried was increased to 45, and the boats were equipped with torpedo tubes.

The U.C. boats were of a type designed both for mine-laying and torpedo work. At first only a limited number of these was built, which had a displacement of 150 tons. The displacement was increased ultimately to 400 tons, and the new boats had a speed of 11 knots on the surface and of 6.5 knots under water. Eighteen mines and four torpedoes for the three tubes were carried. These boats were distinguished by a raised forecastle with—in the later constructions—a 22-pounder gun in the dip in the deck between the bows and conning-tower. They were

equipped with a net-cutter at the bow and their stern was awash in surface trim.

U-boats usually remained at sea for between 21 to 28 days, the coastal U.B. boats from 7 to 17, and the U.C. boats from 10 to 20, depending upon whether they were operating in the North Sea and the Atlantic approaches or in the English Channel. One U.C. boat is known to have remained at sea for 55 consecutive days.

The *Deutschland* class came into prominence through the successful voyage of the first of this type to America and back in the summer of 1916. She carried merchandise on both the outward and homeward voyage. The success of this experiment led to the building of similar types for war purposes. The first of these craft were double-hulled boats, 213 feet in length, with a beam of 29 feet and a displacement of, in the first series, 1,200 tons. Their appearance was distinguished by their high freeboard and by the two 15-centimetre (5·9-inch) guns, one of which was mounted before and the other abaft the conning-tower. They were equipped with two torpedo tubes and could stow up to 30 torpedoes, and a number of mines was carried. Their maximum speed on the surface was about 9 knots, and they were capable of maintaining a speed of 5 knots for a short time when submerged. Their endurance was remarkably high, for they could remain at sea for a continuous period of 3 to 5 months, and in some of their cruises they reached as far as the Azores. In fact they could cover, without replenishing their fuel tanks, some 17,000 miles at a cruising speed of 6 knots.

In consequence of the success obtained with these boats, larger 'cruiser' submarines were built, which were over 300 feet long and had a displacement of more than 2,000 tons. Their surface speed was high—16 knots—and their maximum submerged speed was, for a limited period, as much as 9 knots. Their endurance was greater than the converted *Deutschlands*.

The tactics employed by German submarine commanders when attacking merchant shipping varied, naturally, with the conditions. Usually they tried to reach a position ahead of their target and closed to a range of 300 to 600 yards before firing a torpedo, but in the case of convoys, owing to the danger of an attack from the escorting cruisers or destroyers, they opened fire at greater ranges—sometimes as much as 1,000 yards. After they made an attack they turned away, generally in the direction of their target's stern and tried to see the effect of their shot—although, of course,

if an opportunity offered itself, they would attack another ship. Then they would dive to 80 to 150 feet and proceed at this depth until they felt that they had shaken off their pursuers.

If they used their guns to sink a ship then they attacked usually at greater ranges. Naturally, the state of the sea had a considerable effect on their activities, and in bad weather they lay frequently on the sea-bed until the weather moderated. They resorted also to these tactics when they were being hunted with the aid of hydrophones.

The coming of night did not stop attacks; in fact, in the summer of 1918 almost as many attacks were made by night as by day, although at night-time the attacks were made usually on the surface.

The mine-laying submarines released their mines from inside their hulls. Operations were conducted usually at night-time, the mines being laid at intervals of about 50 yards, or, in groups, although they sometimes laid them singly as far apart as 800 yards. In the North Sea and the Atlantic Ocean they released them in places where the depth of the water varied as much as from 7 to 80 fathoms. In the Mediterranean Sea they sometimes laid them in water as deep as 150 fathoms.

The colour of the mines varied. In home waters they were painted black, but in the Mediterranean Sea green or blue.

To turn now to the part played by aircraft in 1917 in combating the submarine campaign. It was not until March of this year that, owing to the depredations of enemy submarines, a start was made with a definite policy in anti-submarine operations conducted by aircraft. Previous to this, as stated already, such operations had been spasmodic, inco-ordinated, and, therefore, to some extent, ineffective. With the inauguration of this new policy the authorities were faced with many difficulties of material and personnel. The criterion by which the *efficiency* of a particular anti-submarine patrol system may be judged as a *protective system* is the tonnage of ships sunk or damaged within the area of its operations, and not by the number of hours flown, the mileage covered, or by the number of submarines sighted and attacked. Nevertheless, if the agent employed for such offensive attack can be foiled in its endeavour and could be destroyed in addition, so that the enemy's means to further destruction were reduced, 'all were done, all were won and got were all the gain'.

The Admiralty placed the naval air stations (engaged in the duties described) under the local commander-in-chief or senior naval officer, and it was established speedily that the efficiency of

anti-submarine work was in direct ratio to the standard of co-operation between the two authorities. The local naval authority was responsible for searching and salving stranded and wrecked seaplanes, and, where the conditions permitted, they were assisted in this duty by the motor-boats at the air station concerned.

There were three types of anti-submarine aircraft patrols, emergency, convoy, and routine. These were based on Intelligence Reports which gave the probable area in which submarines were operating, and whose presence had been detected largely by direction-finding wireless telegraphic stations. The emergency patrols were sent out by commanders of units on the receipt of a report stating that an enemy submarine was in the vicinity. Convoy patrols were ordered by the Group Head-quarters, and were for the purpose of escorting ships that were under convoy, or, in particular cases, single ships. Routine patrols covered particular areas, and were made on Intelligence Reports which gave the probable areas in which hostile submarines were operating, and these were liable to alteration according to circumstances.

For ordinary patrol work it was found that the best height at which to fly was 1,000 feet. At this altitude, provided the weather be clear, the distance of the sea horizon is 36 miles, but for convoy work a height of 600 feet was found to be the most suitable. This was such that while the danger zone of the convoy was well within the radius of vision, it was possible to pick out in clearer detail (than at 1,000 feet) surface objects, and so obviate the possibility of surprise. Escorting aircraft flew usually at the van and rear of the convoy, and their role was a defensive one. Aircraft were successful particularly in this field, for, taking into account the short sea voyages where air escort was practicable throughout the voyage and neglecting the ocean convoys (which, however, were escorted by aircraft through the danger zones), it is important to note that from April 1917 to the conclusion of hostilities 312 ships were torpedoed while in convoy. Of these attacks only two occurred when the vessels had an air escort in addition to the usual destroyer or cruiser protective company. In no case was a ship lost from a convoy when a kite-balloon was flown from an escorting ship.

If, however, attention be turned to the *destruction* of submarines by aircraft, then the story, unfortunately, is a different one, for the general conclusions made at the close of the campaign would appear to indicate that, while aircraft can protect ships indivi-

dually and in escort, and are able to detect submarines, they cannot, as shown by experience, destroy them when they have been found. In home waters during 1917, 169 submarines were sighted by aircraft and 130 attacked. Of the total of 199 German submarines sunk during the war by various agencies only 7 are known to have been sunk by aircraft, and about 20 severely damaged and an equal number slightly damaged. The ratio of known sunk to those sighted and attacked was therefore very low.

One of the suggested reasons for this apparent ineffectiveness was that pilots were generally too precipitate in making their attack. In the majority of sightings only the periscope and, more rarely, part of the conning tower, was visible—usually some distance away. In such cases it would appear that pilots, on sighting either of these objects, dived to the attack, and, by the time they arrived over her 'wash' the submarine had submerged, usually leaving but a swirl and perhaps a faint trail of oil on the surface. The pilot, ignorant, naturally, of the underwater course of the submarine, released his bombs on the position he decided she occupied. The explosion of the bombs warned the commander of the submarine that he had been seen, with the result that he did not 'break surface' again for some hours, and usually, during the interval, the aircraft had been compelled to return home through shortage of petrol.

If a seaplane caught a submarine on the surface it was due, generally, to gross carelessness on the part of the look-out in the boat. It is reasonable to suggest that, in general, had pilots refrained from bombing a submarine under such conditions, and had waited in the air until she came to the surface again (which she usually did within an hour, unless molested), an opportunity for a more successful attack than before possibly would have presented itself.

The other suggested reason for the ineffectiveness of aircraft (as a destructive agent against submarines) was the frequent lack of co-ordination with the ships hunting on the surface. This ineffectiveness was due mainly to errors in the position of the aircraft and the slow speed of the hunting ships which usually were available.

As one officer of the submarine branch of the Royal Navy has said:

--

'Aircraft were an infernal nuisance. You never can be certain if they have seen you or not and the tendency is to take it for granted that they have done so. If you are then in enemy waters you must be on the *qui vive*

for being hunted by the usual methods; if not in actual enemy local waters, you feel that your chance of a target has gone for the day, and that, even if a target does come by, she will be well protected and on the look-out for periscopes.'<sup>1</sup>

This view would appear to represent the general opinion of experienced officers of both the Royal Navy and the former Imperial German Navy.

<sup>1</sup> *The Story of our Submarines*, pp. 115-16.

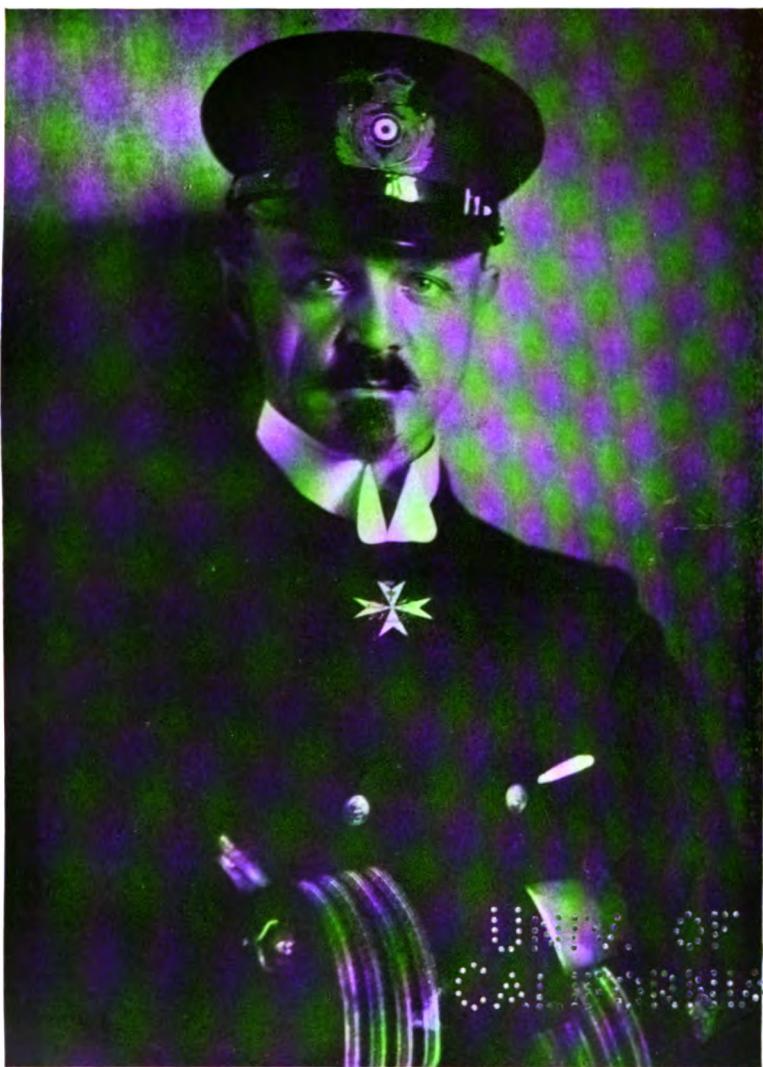
## XIX

### THE DEVELOPMENT OF THE ZEPPELIN AIRSHIP AND THE IMPERIAL GERMAN AIRSHIP SERVICE DURING THE WAR

**I**N the preceding chapters an account has been given of some of the progress made by the different anti-aircraft defences in Great Britain constructed to counter the activities of the enemy airships. It is felt that some description of the technical development of these airships is desirable and convenient at this stage, in order that the difficulties of the defence may be appreciated. During the War this development was most remarkable, especially in the case of those of the Zeppelin design. While the Schütte-Lanz and the Parseval airships rendered good service within limits, they were found to be unsuitable for work over the North Sea, and for this reason this chapter will be devoted to a recountal of the development of the Zeppelin airship alone.

It was the original intention of Graf von Zeppelin that the principal role of the airships built to his design should be that of reconnaissance, and this duty was performed during the early days of hostilities. Military airships cruised over the eastern theatre of war, and over Belgium and France, to observe the movements of troops. However, it was seen at an early date that such work was fraught with great risk to the airships and to their highly trained personnel, for the ships were unable to reach heights at which they were immune from gun-fire from the ground. For instance, *Z. VIII* was shot down on August 23, 1914, over the Vosges by gun-fire. *Z. V* was brought down by shrapnel over Liepovick, near Mlava, in Poland, on August 29, 1914. As a result of these losses it was apparent that bombing raids during daylight must be abandoned, and cruises made during the night must take place in lieu.

The only naval airship in commission at the start of hostilities was the *L. 3*. She had a capacity of 950,000 cubic feet (27,000 cubic metres), with a net lift of 10.9 tons, and her speed with 3 engines, each of 210 b.h.p., was about 46.5 miles an hour (75 kilometres an hour). With a load of 2.95 tons (3,000 kg.) her static ceiling was 9,200 feet (2,800 metres). She made 141 trips over the North Sea during the last months of 1914—on one



FREGATTENKAPITÄN PETER STRASSER.

1960. *Verde*  
A. *Verde* 1960.



L. 12.

22  
23  
24  
25  
26  
27

occasion remaining in the air for over 34 hours. As a result of the experience gained with her, the German Admiralty recognized more than before that in the airship it had a weapon of great value, and it strove to equip the Fleet with new and improved types.

During 1914 the following Zeppelin airships were commissioned for duty with the fleet: *L. 4* (August 30), *L. 5* (September 24), *L. 6* (November 3), *L. 7* (November 22), *L. 8* (December 18)—all these were, more or less, replicas of *L. 3*. The reasons why there was, at this stage, no departure from this type were that additional airships were required urgently, and by adhering to a known model the makers were able to build completely an airship in 6 weeks, and, further, that the existing sheds would not permit the housing of larger ships.

In April 1915 a new and more efficient type of Zeppelin airship was commissioned for service with the Army—the *L.Z. 38*. She had a length of 530 feet (163.5 metres), a maximum diameter of 59.5 feet (18.7 metres), and a capacity of 1,130,000 cubic feet (31,900 cubic metres), and the ratio of the length to the diameter decreased from approximately 10.6 in the case of the early ships to 8.7, which meant a more efficient hull and a higher speed for the same power 'input'. The increased capacity permitted also a better hull form and a sharper stern; in short, she was more—to use a common phrase—'stream-lined'. As a result of all these changes her speed was greater than that of her predecessors, for *L.Z. 38* attained a speed of 58 miles an hour (94 kilometres an hour), and the ratio of net lift to gross lift was 37 per cent., while her static ceiling was in the neighbourhood of 9,000 feet (2,750 metres). At full speed she was able to cover a distance of 3,600 miles, or exactly double that of which *L. 2* was capable.

This class (*L.Z. 38*) passed, in 1915, into the Navy as the *L. 10* class; of these there were 10 in number, *L. 10* to *L. 19*, although previous to this a slightly smaller airship, *L. 9*, had been commissioned for this service on March 8, 1915. The first of the *L. 10* type passed into the naval Service on May 13, and the last on November 27 (1915). These naval ships showed small improvements in design over their military prototype. For instance, the speed of *L. 10* was 61 miles an hour (98 kilometres an hour), the ratio of net lift to gross lift was 44 per cent., and her maximum static ceiling was 12,800 feet (3,900 metres).

Including the original of this class (*L.Z. 38*), 3 of these airships were destroyed by English forces. *L.Z. 38* was bombed in her

shed at Evere on July 7, 1915; *L. 12* was hit by anti-aircraft gunfire from Dover and destroyed off Ostende on August 10, 1915; and *L. 15* suffered a similar fate off the Kentish coast on March 31, 1916; while *L. 10* was destroyed by lightning on September 3, 1915, at Neuwerk, off Cuxhaven, and *L. 19* was lost in the North Sea about February 2, 1916. It is interesting to note that *L. 14* survived the War, but was destroyed on June 19, 1919, during the German Revolution.

This class of airship proved remarkably serviceable and was easy to handle on the ground. Particular attention was paid to the form and arrangement of the gondolas, of which there were 3, namely, the pilot car and the forward engine gondola, both of which were built together into one stream-lined body, and the rear engine gondola (the latter containing 3 engines each of 240 b.h.p.). Their armament was improved also, for the bomb racks and the release gears were of a better design and more machine-guns were provided, two being mounted on the envelope near the ship's bows.

A further improvement was made in the construction of the *L. 20* class. Although these had the same diameter as the *L. 10* class, the ships of the former type had a larger capacity—actually 1,340,000 cubic feet (35,800 cubic metres). This greater capacity resulted in an increase of the net lift to 17.6 tons (17,900 kg.), while the static ceiling was raised to 13,800 feet (4,200 metres) without any diminution of speed, the total horse-power being the same. Five airships of this *L. 20* class were delivered during the first months of 1916 to the Navy and two to the Army. These airships were somewhat unfortunate. *L. 20* was wrecked on May 3, 1916, at the Hafsfjord, Norway, when returning from a raid. *L. 21* was shot down by a pilot from Great Yarmouth air station on November 28, 1916; *L. 22* suffered a similar fate on May 14, 1917; *L. 23* was destroyed on August 21, 1917, off the Danish coast by the pilot of a Sopwith Pup flown from the deck of H.M.S. *Yarmouth*; and *L. 24* was destroyed accidentally, on December 28, 1916, when entering her shed at Tondern; the resulting fire also destroyed *L. 17*, which was in an adjoining shed.

Towards the end of 1915, owing to the improvement in the British defences, the German authorities realized that it was necessary to produce a new class of airship which should have a higher ceiling and increased speed. It was realized that, if airships were built which were to be capable of ascending to greater

heights than hitherto, they must be capable also of attaining higher speeds, because their pilots must expect to meet wind currents of greater strengths with increasing altitude.<sup>1</sup> So, speeds of above 56 miles an hour were, for this reason, desirable, for winds of between 35 and 40 miles an hour are not uncommonly met at high altitudes, especially over the sea. An airship which could ascend to great heights, and at the same time have a speed of about 67 miles an hour, could be constructed only if it were of very large dimensions, for otherwise engines of the requisite horse-power could not be installed. A capacity of approximately 1,975,000 cubic feet (56,000 cubic metres) was decided upon, therefore—nearly 750,000 cubic feet more than in the *L. 10* class.

The first of this new type—the *L. 30*, of 1,950,000 cubic feet (55,200 cubic metres) capacity—was ready in May 1916. In order to attain the necessary increase of speed, her shape was made as nearly 'stream-line' as practicable, that is, the long, cylindrical part with equal frames was abandoned and the stern was drawn out, so that it took a narrow angle cone-form—in common parlance the end was 'pointed'. Six engines, each of 240 b.h.p., were installed. The arrangement of these was different from the *L. 10* class, namely, one engine in the forward car and three in the after car, as in *L. 10*, and, in addition, two small wing cars slung amidships, each fitted with a single engine with a direct driven propeller. The net lift of the first airship of the *L. 30* class was about 29.5 tons (29,000 kg.), roughly speaking, about 51 per cent. of the gross lift, but this was increased by various economies in weight in the later ships of this class to 61 per cent., which, when compared with the 44 per cent. of the *L. 10* class, showed a marked improvement. The 'ceiling' of these airships (*L. 30* class) was raised also by about 2,000 feet, and they were able to reach, statically, between 11,800 to 17,700

<sup>1</sup> The rate of ascent of any airship is purely a question of the capacity of the pressure-valves of the gas-bags. In the service Zeppelin airships these were designed to answer to a rate of ascent of 8-10 metres/second (25-33 feet/second). This value was uniform for all airships and at all altitudes, that is to say, the rate at which they ascend does not depend upon engine power or the density of the surrounding air. Therefore it took the same period of time to ascend, say, 2,000 feet, whether the airship was initially at 100 or 10,000 feet; so the minimum time taken to ascend from 10,000 to 12,000 feet or from 14,000 to 16,000 feet was a little over a minute, compared to the quarter of an hour or more taken by the attacking aeroplanes. The commanders of Zeppelin airships, however, in view of the larger margin between the rate of ascent of their ships and the rate of climb of attacking aircraft, ascended rarely at such a rapid rate, 'because', in the words of one of their number, 'about half of it was more than sufficient'.

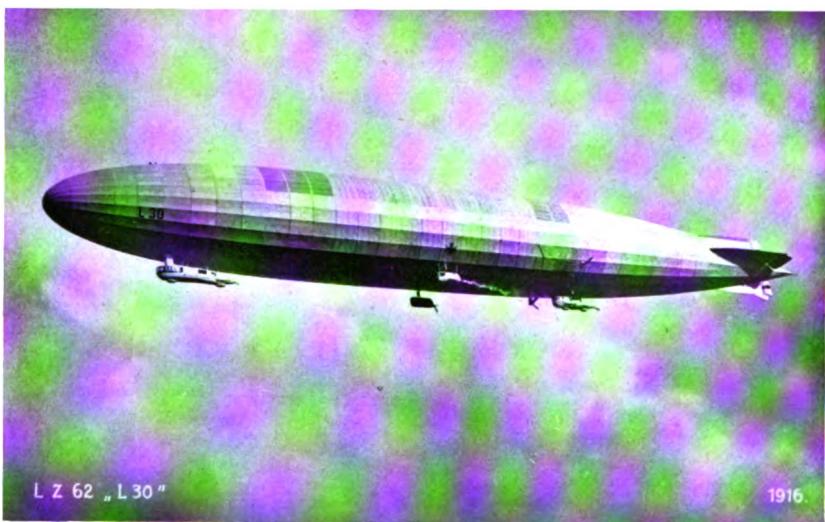
feet (3,550 to 5,300 metres), depending upon the load carried and on the state of the weather. The speed of successive airships of this class was improved. For example, that of *L. 30* was 64 miles an hour, while that of *L. 53* was 71.

This type of ship remained in service until the production of the *L. 70* class in July 1918, although it was altered in detail, and the capacity of succeeding airships of the same type was increased. Ships of this class were very successful, for they could be used in practically all weathers, and their endurance was high because of their larger fuel capacity. *L. 50*, for instance, was capable of travelling a distance of 4,600 miles at full speed, as compared with, in the case of *L. 10*, 2,600 miles.

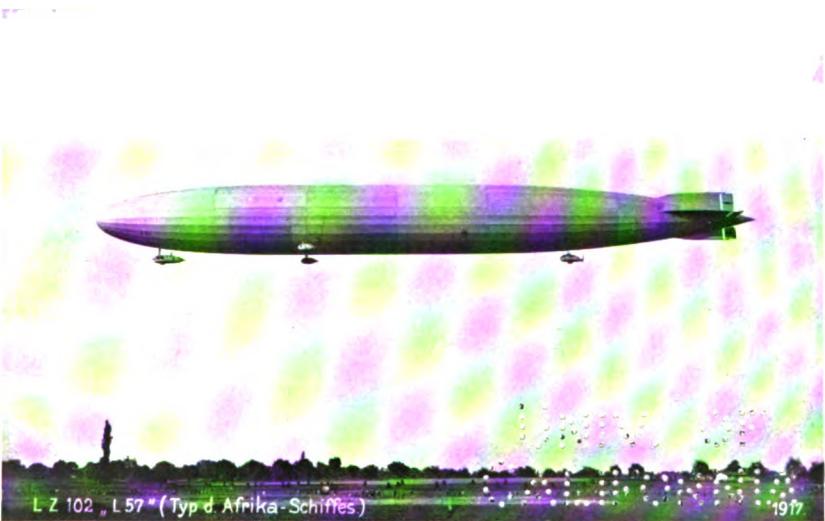
Towards the end of 1916 the continued and rapid improvement in our ground defences, the increase in 'ceiling' of our defending aircraft, and particularly our employment of explosive and incendiary ammunition compelled the German authorities to improve the *L. 30* class. As a result of this the later ships of this type were increased in capacity, in the case of *L. 42* to *L. 65* from 1,940,000 to 1,970,000 cubic feet (55,000 to 56,000 cubic metres), while the static ceiling was increased from 17,700 feet (5,400 metres) in *L. 30* to 27,000 feet (8,200 metres) in *L. 59*.

Each of these airships was more efficient than her predecessor. For instance, the ratio of net lift to gross lift for *L. 30* was 51 per cent. This was increased to 58 percent. in *L. 46*, and in *L. 53* reached 61 per cent. The net lift rose from 32 tons in *L. 30* to 39.5 tons in *L. 53*, and airships of the improved type (*L. 46* to *L. 53*), when loaded with between 6 and 7 tons, could remain at a height of nearly 20,000 feet without having to be forced up while in flight by the aerodynamic reaction of the hull and fin areas due to inclining the airship to the line of flight. During the so-called 'Silent Raid' of October 19-20, 1917, *L. 55* is known to have ascended to a height of 23,000 feet—nearly 4½ miles.

With these increased powers of ascension it became necessary to equip the airships with supercharged engines, for the power developed by an internal combustion engine depends upon the mass of fuel burnt in the cylinders in unit time, and, for the combustion of a given mass of fuel, oxygen to a definite amount is necessary, which oxygen is taken from the atmosphere. At the heights mentioned the air becomes highly rarified, and the mass of oxygen in a given volume of air is less than at lower altitudes, with the result that the power developed by the engines will be smaller at such altitudes unless means be taken to increase the



L. 30.



L. 57.

NO. 11101  
ANNEPUS

supply of air above the normal intake. To provide this increase air is forced through the induction pipe under pressure to the cylinders by means of a fan, so that the mass of oxygen available in unit time may be the same at high as at low altitudes. Engines fitted with such a device are said to be 'super-charged'.

Atmospheric rarification leads to difficulty in breathing, and in consequence much discomfort and other drawbacks are experienced by the crews of airships when at great altitudes. To mitigate discomfort and lessen difficulties they were equipped with masks connected to cylinders which contained compressed oxygen, but later these oxygen cylinders were superseded by those which contained liquid air. This was dropped on to a sponge, and, with the warmth inside the mask, the liquid air evaporated, and by this means the supply of oxygen was increased.

In the summer of 1918 it became evident that, even with all the improvements over its predecessors, the enlarged *L. 30* class was not efficient to the extent necessary, and so the *L. 53* type (an improved *L. 30*), which had a capacity of 1,975,000 cubic feet (56,000 cubic metres), was lengthened by one division, and the capacity increased to 2,200,000 cubic feet (62,200 cubic metres). The resulting airships so constructed became known as the *L. 70* class. The horse-power was increased, this increment being produced by the addition of two more engines, making a total of 7 instead of 5, which were each of 260 b.h.p., so that the aggregate horse-power was 1,820 b.h.p., over 600 b.h.p. more than in *L. 59*. The ceiling became 23,000 feet (7,200 metres), or nearly 4,000 feet (1,200 metres) less than the latter airship, but shortly before the Armistice a decision was made to introduce certain alterations which would have increased this ceiling to that of *L. 59*. The net lift of *L. 70* was slightly over 43 tons, and the ratio of net lift to gross lift was 61 per cent. In all the airships of this class, namely, *L. 70*, *L. 71*, and *L. 72*, the weight of the hull had been reduced to such an extent that, at certain critical speeds (with the engines running at 1,200 revolutions a minute), the hulls used to (in the words of one of their pilots) 'undulate—but only occasionally—they were not excessive and not observed at higher speeds'. This phenomenon was observed on the flights of *L. 71* and *L. 72* when they were handed over to the French and English Governments respectively.

At the time of the Armistice another class of airship—the *L. 100*—was in the design stage. Airships of this projected class were to be 781 feet long, 96 feet in diameter, with a capacity of

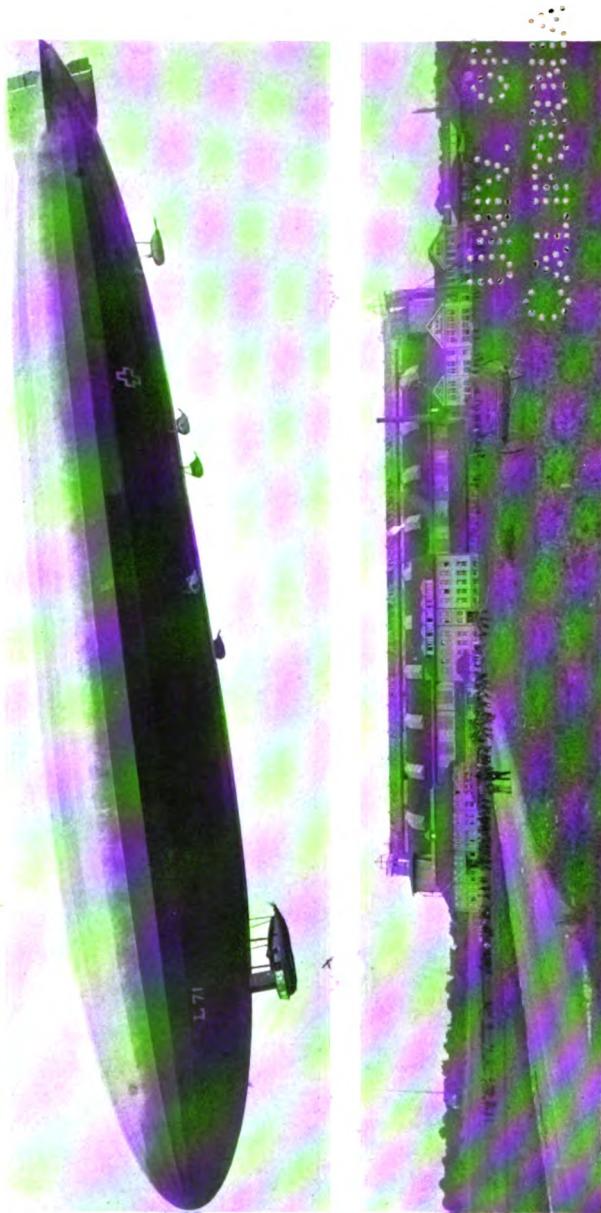
3,814,000 cubic feet. The net lift was to be nearly 81 tons, with a speed of, approximately, 81 miles an hour, and the ceiling was to be over 30,000 feet. The engines were to be 10 in number, of a total horse-power of 2,600.

In the early types of Zeppelin airship the lift of the gas was transmitted from the gas-bag containing frame to the keel running inside or outside the bottom of the framework, this keel being strong enough to resist all vertical shearing stresses and bending moments. The main weights were suspended from, or connected directly with, the keel. This arrangement permitted, therefore, the distribution of the load over the whole length of the hull, and so prevented concentrations of weight. A corridor, generally internal (except in the earlier ships), was built between the main frames to act as a gangway and to carry the local weights of the engine cars, petrol, and the like. The framework of the whole hull was not designed to resist the main stresses to which the airship might be subjected, and served only to maintain the form of the gas-bags and to transmit the lift to the keel.

In the later ships this arrangement was altered, and the hull framework was designed to be able to sustain all stresses when the ship was in flight; moreover, the engine cars and controlling surfaces were directly attached to it.

The following technical particulars may give some idea of the progress made in the design of these airships during the War. For instance, taking two ships—*L. 3* and *L. 70*—the capacity increased from 950,000 cubic feet to 2,200,000 cubic feet, the speed from 46.5 to 81 miles an hour, the static ceiling from 9,200 to 23,000 feet, the endurance at full speed from 1,300 to 7,450 miles, the net lift from 10.9 to 43.8 tons, and the ratio of net lift to gross lift increased from 35 to 61 per cent.

These results could not have been obtained unless the design and construction of engines suitable for airships had made equal progress. In the first of the Zeppelin airships the weight of each of the two 15 b.h.p. Daimler engines was 847 lb. (385 kg.), which gives a horse-power weight ratio of 56.5 lb. (25.7 kg.). This figure was improved in *L. 3* to 5.64 lb. (2.56 kg.). During the War an equally marked improvement took place in the Maybach engines with which all the Zeppelin airships were equipped, for the horse-power of the single engines rose from 170 to 180 b.h.p., then from 180 to 210 b.h.p., from 210 to 240 b.h.p., and finally to 290 b.h.p. The weight per horse-power ratio decreased from 5.65 lb. (2.56 kg.) in the case of the 180 b.h.p. engine to 3.3 lb.



L 71.

Age

(1.5 kg.) in those of 290 b.h.p., while the engine speeds increased only 200 revolutions a minute, that is, from 1,200 to 1,400 revolutions a minute, so that this improvement was a most meritorious one. The petrol consumption showed also a marked diminution, for the consumption per horse-power hour of the 290 b.h.p. engines of *L. 70* was exactly half that of the 15 b.h.p. engines of *L.Z. 1* and 12.5 per cent. less than that of the 180 b.h.p. engines in *L. 3*, for in the case of *L.Z. 1* it was 0.882 lb./b.h.p./hr. (400 grammes), while in *L. 3* the figure was 0.496 lb. (225 grammes), and for *L. 70* it was 0.441 lb., or 200 grammes.

It has been suggested frequently that the improvements made in all these airships were not the result of direct research but of experience, and that of research—in the true sense of the word—there was little, owing to the urgent and ever-pressing need to produce ships in the shortest possible time. This view is not correct, however. As one of the most experienced members of the staff of *Luftschiffbau Zeppelin G.m.b.H.* (in a note which he contributed for this history) says:

‘The statement that the Zeppelins were developed empirically and not on the basis of scientific research is not correct. I know that this impression is prevailing in England, but it is nothing but an amusing fable. . . .

‘The story has some, but very little, justification as far as conditions up to 1914 are concerned—because at these times we had to spend what little money there was on actual ships rather than on small-scale experiments and research. But thereafter, I do not know of any place where all the harness and equipment of pure science was requisitioned and utilized more earnestly and thoroughly for airship development, than the Zeppelin works at Friedrichshafen. For instance, the first *correct* theories of airship aerodynamics and the first *complete* strength calculations for airship structures were developed here in 1914–15, and they are still at the basis of our present work, amplified and improved of course by constant detail- and full-scale research. The first really modern wind-tunnel, which is still one of the largest and best in existence, was designed and built here in 1914–15, also the first low-pressure chamber. I could add an almost endless list of examples taken from all branches of aircraft- and engine-development, but I believe that one simple argument would be more than enough, namely, the fact that the absolute and relative performance of Zeppelin airships has never been equalled at any one time by any other builders, and that throughout the Zeppelin development there was never a case of serious structural failure, such as occurred everywhere else. Such constant and continuous satisfactory results could hardly have been obtained without a thorough and solid scientific basis—unless of course they are ascribed to a whole series of rather marvellous pieces of luck.’

The difficulties that the designers and constructors of these airships had to combat have been summarized by a German authority, who stated:

'The first of all these was reliability. Both ship and engine had to be built for endurance and for flights entirely free from trouble, because the airship often had to remain in the air for several days on end. . . .

'The airship had to be as small as possible. The bigger it was the more difficult and hazardous became the handling of the vessel on the ground, and the processes of housing and bringing it out of its sheds. Furthermore, great size required the employment of large crews, with the result that more valuable gas, petrol, and oil had to be used.

'The airship had to be fast in order to reach its objective without delay, outstrip its enemies, and make way against a strong head wind. . . .

'The actual net lift had to be considerable, for it offered the pilot the choice either of saving his petrol by flying low when engaged on long-distance flights, or else of climbing to a great height where he was immune from hostile attacks. In addition to this, the net lift regulated the quantity of bombs and the armament which could be carried.

'Every one of these considerations was important, and in the course of the War first one, then another was considered most vital. . . .

'In spite of the adverse criticism of the ignorant, airship designers achieved all that was humanly possible during the War. . . .

'The ever-changing objects with which airships were planned cannot be described . . . in detail. Over and over again the same thing happened. A specific type was constructed, and meanwhile, perhaps, the enemies' defensive measures have been developed. Consequently, the airship had to be able to climb more rapidly, and therefore the lift had to be increased. As soon as a new type was built to meet these requirements, instructions were received that some other quality, such as speed, must be improved, because the ship designed for rapid ascents was too slow.

'The untechnical critics responsible for these unceasing demands never realized that every airship is a compromise between conflicting qualities, and that frequently, beyond certain limits, one quality can only be improved at the expense of another.'<sup>1</sup>

Space forbids a description of how these difficulties were combated, but that they were largely overcome is known, although considerable obstacles were met with at every turn. For instance, the aim of the designer for lightness in construction frequently brought him into conflict with the pilot, who always wanted the equipment of his ship to be as complete as possible. Again, the problem of wind resistance was one of difficulty, and upon its solution depended considerably increased speeds for the same

<sup>1</sup> *Die deutschen Luftstreitkräfte im Weltkriege*, pp. 16-17. (English edition.)

power 'input'. Every cause of resistance was eliminated wherever practicable—hulls were made more 'stream-line' and were carefully 'doped', closed gondolas superseded open ones, which from being 'at first angular and awkward in shape were themselves stream-lined'. The geared propellers of the early ships (which were placed high up to avoid being damaged in a forced landing—fairly frequent occurrences in those days) were superseded by those which were direct driven.

Some idea of the progress made in the manufacture of Zeppelin airships may be gathered from the following list of such airships built during the War at the four factories of *Luftschiffbau Zeppelin G.m.b.H.*:

	1914.	1915.	1916.	1917.	1918.	Total.
Friedrichshafen . . .	6	19	14	14	6	59
Potsdam . . .	1	7	8	—	—	16
Staaken . . .	—	—	2	9	1	12
Frankfurt-am-Main . .	1	—	—	—	—	1
Total airships . . .	8	26	24	23	7	88

In all these airships considerable attention was devoted to the armament—both machine-guns and bombs—and with each succeeding class the number of machine-guns was increased and a heavier and a greater number of bombs was carried.

In the earlier Zeppelin airships one machine-gun was carried forward on the platform on the top of the hull, and one in the bow and one in the stern car (although in Schütte-Lanz airships of the same period two additional ones were carried—one in each wing car); the upper gun was manned by its own gunner, the others were served by the engineers. A certain number of automatic rifles and pistols was carried aboard also. In 1916, when raiding England, it was found necessary to mount a second machine-gun on the top of the hull and in each car, and a gun position was built in the stern of the hull.

With regard to the guns on the top of the hull it was found that the gunner, on account of the wind and cold, was not able to load and serve his gun fast enough if the ship were being attacked by aircraft, so that in the end it was found necessary to mount three guns and carry two gunners to serve them.

The calibre of the machine-guns mounted was at first 0.08 cm. (0.315 inch). This was then increased to 0.14 cm. (0.55 inch), and finally the standard water-cooled Parabellum gun was mounted. These guns used the ordinary small arms ammunition,

with which were intermingled ordinary tracer bullets and a special explosive tracer which burst at a distance of about 330 yards (300 metres), the resulting explosion emitting a cloud of black smoke which marked the line of flight of the bullet.

During part of 1916 and 1917 only two machine-guns were carried, and at one period none at all, in order to save as much weight as possible, when it was found that the airships, when raiding, were unable to rise high enough to evade the attacks of aircraft. With the coming of the *L. 70* class in 1918, the ships were equipped (in addition to machine-guns) with the 2-cm. (0.787-inch) automatic gun firing only explosive ammunition, but actually these guns were never used in combat.

Airships carried incendiary and explosive bombs and star shells. The incendiary bombs were cylindrical in shape, 40 cm. (15.75 inches) long and 17 cm. (6.7 inches) in diameter, and were filled with a charge of solid carburetted hydrogen and thermite paste which weighed 11 kg. (24 lb.). The exterior of the bombs was covered with fibre soaked in resin. Under the loop from which they were hung from the release gears was a stabilizing cap, which prevented the bomb from turning over while it was falling. On impact these bombs burnt with a very hot flame which was difficult to extinguish, but they were not dangerous in open spaces. Bombs of this type were very light, so that up to 80 could be carried in each ship.

The explosive bombs weighed 50, 100, and 300 kg. (110, 220, and 660 lb.). Inside their pear-shaped iron case they had the same type of explosive charge which was used in the German naval shells, mines, and torpedoes. The length of a 300-kg. bomb without its loop and stabilizing cap was 1.20 metre (47.25 inches), the maximum diameter was 50 cm. (19.7 inches). The weight of the explosive charge was about three times as great as that contained in the shells of the largest calibre as used in the German Navy.

The star shells, on bursting, released a parachute to which was attached a magnesium flare. The fuse of these shells could be arranged to make the charge burst at any fixed height above the ground, for they were used to illuminate the ground during night raids.

With the exception of the star shells, which were thrown out by hand from the side windows of the pilot's car, all the other bombs were hung along the corridor of the ship and were released electrically from the pilot's car. In this car was a panel from

which the number and kind of bombs dropped could be regulated. They could be released individually or by volleys, and the type and weight of each bomb was indicated by a coloured lamp on the panel, for instance, a blue light was used for the 300-kg. explosive bombs, a green one for the 100-kg., and red for the 50-kg. bombs.

Along with the problems associated with the development of the airships themselves was the equally difficult one of housing them and providing gas plants. The German airship authorities pinned their faith entirely on sheds. They did not, like the British airship Service, conduct experiments with mooring masts. Owing to their size, the building of sheds took a considerable period of time, absorbing also a large amount of men, money, and material. The use of sheds for housing airships has also the disadvantage of requiring a large number of men for 'handling parties'. At Ahlhorn in 1917 this party numbered over 1,000 men for the handling of 8 airships. This and other difficulties have been enumerated by one airship commander, who stated:

'In peace time the Navy only possessed the aerodrome at Nordholz, which, however, was of the most modern description. A revolving shed for two ships made it possible for the ships to take the air in any wind, even during bad weather. In the course of the War, when it became necessary to provide sheds for a large number of ships, the question arose as to whether the Army practice of building only one shed to each aerodrome should be followed, or whether several sheds should be grouped together at one place.

'On account of the numbers of men it was necessary to station at each aerodrome, the latter plan was adopted by the Navy, and rows of sheds were set up at Nordholz, Hage, Namur, Tondern, Ahlhorn, Seddin, and Seerappen.

'The great drawback to the double shed was the possibility of losing two ships simultaneously in case of fire. Even building sheds close together was unadvisable, for at Ahlhorn it once happened that an explosion in one shed destroyed several others together with the ships they contained.<sup>1</sup>

'The sheds had to be of the most up-to-date design, with mechanical aids for taking the ships in and out, methods of suspending deflated or damaged ships, gas apparatus, and so forth. Unfortunately, revolving sheds were not built during the War. The only existing shed of that type, which was at Nordholz, was lengthened in order that it might house the bigger type of airship. Even then, it was not large enough for the latest types, but a further lengthening was not possible. . . .

'As the War progressed the question of gas supply to airships became of

<sup>1</sup> *L. 46, L. 47, L. 51, L. 58, and S.L. 20* on January 5, 1918.

paramount importance. The demand for gas was ever-increasing with the number of ships and the great heights at which they worked. Every ship on landing had to be refilled with gas and made ready for another flight as quickly as possible. Naval airships alone, for example, required 5,650,000 cubic feet of gas daily. This vast amount was supplied mainly by private firms, who set up quantities of new plant and greatly increased their output. In the case of those stations where the existing plant produced an insufficient quantity to satisfy the daily demand, gas was supplied by rail on trucks specially designed for the purpose.

'In the early stages of the War the insufficient and poor quality of gas was the cause of much trouble and many accidents. These difficulties, however, like all others, were overcome by indefatigable labour and research.'<sup>1</sup>

During the War the following naval airship stations were in commission: Ahlhorn (destroyed in the great explosion of January 5, 1918), Dresden (closed down November 1916), Fuhlsbüttel (closed down October 1916), Hage (closed down April 1917), Jueterborg, Kiel (closed down October 1916), Leipzig (closed down April 1915), Nordholz, Potsdam (closed down August 1917), Seddin (closed down November 1917), Seerappen (never completed, closed down November 1917), Tondern (broken up in the winter of 1917-18), Wildeshausen (handed over to the military airship branch July 1917), and Wittmundhaven (handed over to the military airship branch August 1917). There were a total of 33 sheds at these stations (of which only one was a 'double revolving' one—that at Nordholz), and in these 54 ships could be housed.

Contemporaneous with the technical development of the airships themselves was the development of the Airship Service. This Service was started in 1912, and the officers and crews received their early training in the airships owned and operated by the German Airship Transport Company (*Deutsche Luftschiffahrt A.G.*, commonly known as DELAG from the initial letters), and for this purpose they were stationed at Frankfurt-am-Main, while the necessary training in navigation was given at Hamburg and Fuhlsbüttel in the passenger airships *Viktoria Luise* and *Hansa*, which were previously the property of DELAG.

Before the War the training of the Army airship crews also was done almost entirely by DELAG, the officers and men being posted in small groups to the various airships operated by the company. In these they received instruction during the course of the normal passenger voyages, besides making numerous

<sup>1</sup> *Die deutschen Luftstreitkräfte im Weltkriege*, pp. 32-4. (English edition.)

training flights when the weather was too bad to allow of taking civilian passengers.

During the War the military airship authorities established a special school of their own at Jueterborg, near Berlin, using at first the old *Z. IV* (built in 1912-13) and later the *L.Z. 72* as training ships. Two other schools were established later—at Tegel and Johannisthal—but they were quite small. In January 1917 a start was made with a big training base at Spich, which was intended to be the main training centre, but as the military airship was broken up in the spring of the same year this school was never used to any extent.

At the outbreak of hostilities naval officers and crews received their preliminary training in a school at Leipzig, but in April 1915 this school was transferred to Dresden and training flights were made in the *Viktoria Luise* and *Sachsen*, the course lasting 4 months. After this period of training was completed the trainees were sent to Hamburg for a period of 9 months, where instruction took place in more modern airships, but after October 1916 all flying training was done at Nordholz. The men who were posted for duty with the airship Service were, on arrival at the training stations, formed into crews, and these crews received their instruction together and later joined an airship as a unit, with the result that the 'team-work' was good. Training was very thorough (on an average 10 crews were under instruction at one period), and during the last months of the course the time was devoted mainly to technical instruction. Each member of the crew was taught navigation, machine-gunnery, and elementary aeronautics, and, in addition, some instruction was given on the subject of petrol engines, sufficient at least to enable a rating to diagnose and correct the troubles ordinarily met with in engines. The engine-room mechanics spent 3 weeks at the Maybach engine and Bosch magneto works. The wireless telegraphic ratings were trained at Fensberg and Berlin.

The normal crew of a naval Zeppelin airship numbered 23, comprising: one commander (usually a Kapitänleutnant), one officer of the watch (usually an Oberleutnant), who was also the 'wireless' officer, one quarter-master, one engine-room artificer, 4 coxswains, 12 engine-room hands (stoker ratings), one sailmaker, one petty officer telegraphist, and one wireless telegraphic rating. Each ship had also 24 men who acted as her 'ground working-party'.

The discipline and *esprit de corps* of the crews reached a very

high standard, as befitting a Service that 'lived dangerously', and particular attention was paid to the attainment and maintenance of a high standard of physical fitness.

The duties which devolved upon German naval airships during the War have been summarized by one of their commanders as follows:

1. Day reconnaissance of a general nature in the North and Baltic Seas (including the Skagerack and Kattegat) which was often extended to the British coast. In summer, night reconnaissance was also carried out.
2. Reconnaissance for naval actions and special expeditions.
3. Protection of the Fleet under way and escorting arriving and departing auxiliary cruisers.
4. Protection of the mine-sweepers by day and at times locating mines.
5. Raids on England and Russia, in which, in addition to the actual effect of the explosions and fires started, the moral effect on the enemy was not to be underestimated.'

It is thought that a description of these activities in the words of certain airship commanders will be of interest.

The preparations for a flight, and the flight itself (in *L. 54*), are described by an experienced and distinguished officer—Kapitän-leutnant Hans von Schiller—as follows:

'On the next day we had the order to patrol. "L. 54 west! On guard", were the curt words of the order, and yet those few words, with the addition of "Ascent 3.0 a.m.", meant a great deal. The western patrol required the greatest attention because of its position nearest to the enemy; almost daily, English aircraft pilots had appeared there, near the islands, and several of our brother officers had been shot down already by them. At 2.0 a.m. telephone activity began again; reports had to be made about the possibility of starting, weather reports had to be studied and so on. Everything was ready in the airship, only the bombs and ammunition were still lying outside the shed in bomb-proof chambers.

'Punctually at 2.0 a.m., the "treefrog"<sup>1</sup> arrives with the latest reports, light breezes up to a height of 13,000 feet. A few small clouds in the sky, in between which the stars shine brightly; all of which offers prospects of a good flight.

'Out of bed! Crew and handling parties are awakened. In a few minutes activity reigns in the shed. The crew, aided by the ship's working party, are engaged in the last-minute preparations for the ascent.

'With an angry-sounding cough or a report like a gun one of the engines starts up—"Mind the propeller!" some one yells from the gondola; the clutch is put in and the propeller beats round, whirling up a cloud of dust

<sup>1</sup> The nickname for the meteorologist.

from the floor of the shed, but it is taken out again after a few seconds' trial run—telegraph bells ring—telephone horns shriek—the shrill tone of a battery whistle joins in; in short, a devil of a row.

'At last the noise dies down—all the engines are running perfectly and quietly at their slowest revolutions, only the words of command to the men loading ballast and ammunition are heard from the ship. Now the last bombs are hung up, the water hose-pipes are handed out of the ship and she is weighed off. The sacks of sand ballast hanging outside the ship disappear, and suddenly the Colossus rises of its own accord from its shores. We are ready to leave!

'Meantime, the man responsible for the shed has had the doors opened on the side away from the wind and has posted the handling party at the ship and the ropes. The Officer of the Watch reports to the Captain, "All clear for leaving the shed, Sir." The ship is floating free in the shed; the shores which are usually under the cars are gone. "Start!" says the Captain to his Officer of the Watch.

'The latter goes quickly through the open door a little way on to the aerodrome, to satisfy himself by a look at the wind-sleeve on the roof of the shed that it is all right to leave the shed. A seaman from the meteorological station gives him, briefly, information about the direction of the wind, which is diagonal to the direction of the shed, but which is only blowing about 5 miles per hour—we can start safely.

'A shrill whistle blast and then the order: "Airship Ma-a-a-arch!" The handling party begin to move. Besides pulling at the cars which reach to the ground (the fore and aft cars—the side cars are about  $6\frac{1}{2}$  feet higher up) and by which the ship is guided and kept off the ground, the greater number of men pull the Zeppelin out of the shed with ropes fastened to the framework of the ship near the cars, chiefly fore and aft. Just as the rear car is passing through the door of the shed, the wind seizes the stern of the ship and tries to press it against the wall of the shed; but the trolleys running from the shed on to the aerodrome on rails keep us in the right direction with their guys which lead from the ship to the trolleys.

'Gradually the men increase their speed till at last the Zeppelin has left the shed entirely so that the after part can turn—"Slip astern". At this command the stern ropes are thrown off and at once the stern turns with the wind. The car men have to run very fast, holding the bars with an iron grip.

'About 550 yards from the shed we stop. The ground ropes are now all unreeved, the handling party holding the ship only by the cars. A short level up, for the ship must receive a little impetus for the ascent, so as to rise easily into the air. The last to climb on board is the Officer of the Watch, who has been responsible for the ship leaving the shed.

'Engine-room telegraphs sound through the stillness and one engine starts after another with a growl. Again a shrill ringing. The side propellers whirl round; we are going to ascend straight forward. On the command "Up!" the leading car is let go. The ship rises by the bow—now the rear

car is also clear of the ground—we are rising at an angle with the bows up. At a height of about 330 feet all engines are set at full speed and at a good 60 miles per hour we move westwards to meet the enemy.

‘At a slight angle our ship climbs slowly higher, the wireless antennae are let out and hang with the three long wires in a bow beneath us. The Wireless Officer puts the telephone receiver to his ear, so as to hear at once all relevant wireless messages. After we have passed the height at which our gas-bags are at their greatest distention, and they have become limp again, our ascent is notified to the Fleet by wireless; so long as the ship was blowing off gas the sending of wireless messages was forbidden on account of the possibility of sparking.

‘Soon the coast arrives in sight. The shallows which edge the land for a mile lie there dry with their crooked, shining, narrow channels; a broad white line of foam marks the breaking line of the rising tide. Over the out-lying villages with their thatched houses hiding behind the dykes we go on towards the open sea. Solitary fishing boats, under sail, or with oil engines, standing by their nets come in sight. The crews wave a greeting to us, they know that we protect them, too, with our scouting.

‘On the horizon a green-red spot; Helgoland! In peace time a favourite excursion and watering-place—now a fortress bristling with arms and an important base for our submarines.

‘A searchlight gleams and asks in Morse code our name and destination. We answer, also by searchlight; and there comes back to us, “Good luck!”

‘An hour later: there is more moving on the sea; several mine-sweeping flotillas are at work. They are clearing a way through the barrage laid by the English at the entrance and exit for our U-boats. A light shines through the mist, a searchlight asks for the password and we reply quickly.

‘Now, owing to our more favourable position with regard to the sun we can make out the two great cruisers, the *Seydlitz* and the *Von der Tann*, which are patrolling slowly inside the mine barrage for the protection of the mine-sweepers. Outside the barrage there are three fishing steamers—a so-called “special group”—which are waiting for a returning submarine to pilot her safely through the belt of mines. We exchange messages with them.

‘Ten minutes later the look-out announces—“Submarine ahead, Sir!” We signal her with the searchlight and receive in answer the name of the expected boat. We have already heard by wireless of her successes; hearty congratulations are sent down to her. The crew are standing on deck and wave to us.

‘After this we may at any time come in contact with hostile forces; we go, as is the practice in war, up to 13,000 feet. The bombs are primed and the machine-guns loaded. At this height the crew are obliged to have assistance in breathing; the command—“Oxygen”—is therefore put through to all posts by telegraph and telephone.

‘To make sure that everything is in order we will go the round of the ship. First, let us look about in the pilot’s gondola. Right in the bows stands the Coxswain, before him the compass by which he steers the ship over sea and

clouds. If his course lies over the land, on the other hand, he has the assistance of seeing towns and distinctive landmarks over which he can steer under the directions of the pilot, who is in charge of the navigation on board.

To his port and starboard stand on a ledge the two pendulum-aiming telescopes and beside them the keyboards for the electrical bomb-release gears. By the port wall stands the Coxswain (for the elevator controls) with a row of instruments before him which enable him to see at once the height, temperature of gas and air, and rate of ascent or descent. From these he judges the static condition of the ship. Above the instruments a sort of board hangs from the roof of the car, from which hangs a whole row of wires ending in buttons like empty cotton reels. Some are painted black—those are the wires of the water-ballast containers in the interior of the ship. The red-painted wires lead to valves at the upper edge of the gas-cells, to blow gas out of the cells.

The starboard side of the gondola is taken up by the chart table; above it the engine-room telegraphs are built in. Over each instrument, as well as over the telegraphs, there is an electric light to facilitate reading it when it is dark in the ship.

Behind the chart table and the elevator Coxswain are large windows; in each is a pivot for a machine- or small calibre gun. The partition at the back of the car forms the front of the wireless cabin, just large enough to hold the wireless apparatus and the two wireless ratings. As it is closed in so as to be sound-proof, and is therefore easy to warm, it forms a space which is always at an agreeable temperature, caused by human warmth, but it is hardly ever properly ventilated, as, with the intense cold up aloft—"warm fug is better than cold ozone".

Before we leave the gondola we take out of one of the compartments, with which the side wall is fitted, a little steel bottle containing oxygen with tube and mouthpiece, to take a "pull at the bottle" now and then on the way, when we suffer from want of air.

We climb now up a perpendicular ladder at the front corner of the wireless cabin. The current of air which seizes us as soon as we get our heads out of the gondola presses us against the ladder. We go about the length of a man through the open air, then we are in the interior of the ship. Hardly have we let go of the ladder, when the entrance trap-door closes automatically and the ladder folds up to cause less wind resistance when it is not in use.

We are in the corridor which extends from the bows to the stern under the whole length of the ship. A little forward of where we entered is the "Anchor Point" to which the two large trail ropes, now coiled up, are attached. Right and left, half-hidden between the cells, hang the forward "breeches", ballast sacks, the water from which can be emptied out with one jerk from the pilot gondola. These breeches are fixed right forward and right aft, as they serve as emergency ballast on landing, to lighten the ship fore and aft at once and efficiently, if it is falling unintentionally or too quickly.<sup>1</sup>

<sup>1</sup> In the later ships the fore and aft 'breeches' held 550 lb. of water and the others 2,200 lb.

Above us the gas-cells are hanging limply down; when they are distended they surround the corridor on both sides and reach down to the bottom of the ship.

'We now turn to the stern and stand before the ascending shaft, which goes vertically through the whole height of the gas-bags to a little platform on the top of the ship. Step by step we climb up. Several times we are obliged to halt. We have to climb about 66 feet, which is not easy in rarified air. Even in a town it is not exactly pleasant to climb the stairs of a five-storied house up to the top without a pause, and here we have to climb to the same height on a vertical ladder.

'Thank Heaven! The last rungs are reached, but it was worth it—a wonderful cloud view meets us. The look-out man by the machine-gun, which stands there threatening and ready to be fired, helps us out on to the small platform provided with a windscreens. We will first recover for a few minutes from our exertions and allow our rapidly beating hearts to calm down.

'We are as if sitting on the back of a giant whale, the bows rise and fall before us quite slowly in the breeze, the clouds move beside us, and when they are near us pass by like arrows. Below us we see, through the large rifts in the clouds, the deep, blue surface of the sea, broken by small white patches made by breaking waves. We eagerly scan the sky and sea—every suspicious dot is reported at once by speaking tube to the pilot gondola. The deep peace up here is pleasant; below in the gondolas and in the corridor there is always the disturbing noise of the engines—here there is absolute silence. Only the wind caused by our flight whistles and sings in the wires of the windscreens. The rays of the sun are strongly reflected by the white clouds. Dark spectacles protect the eyes, already tired out by being constantly on the look-out.

'While searching the heavens for aircraft, we have a little talk with the look-out: "If only we could have such luck", he said, "as *L. 23* had with bringing home the prize, the barque *Royal*." "You were at Tondern then and heard it from the men themselves; tell us all about it." "The *L. 23* sighted the Norwegian barque *Royal*. As she seemed a suspicious character, they dropped a bomb near her as a warning, upon which the Norwegian at once lay to, and the crew left the ship in boats. *L. 23* then went down on the water and made a cutter come to the gondola in order to examine the ship's papers. When it turned out that the *Royal* was carrying contraband, a prize crew, consisting of the Coxswain of the airship and a few petty officers, was sent on board in the cutter, and the barque was taken as a prize to Cuxhaven."

'During this talk we recover sufficiently and climb down the shaft again. Below, we visit one after the other the forward engine gondola and the wing gondolas. Through some parts of the corridor we have in a way to force ourselves, as some full water-ballast sacks, hanging exactly opposite each other, almost block the narrow gangway. Close to the middle of the ship fore and aft hang the bombs. One would be enough to blow us to

atoms. But we can trust them calmly, for they are constructed with a large number of precautionary measures to prevent untimely detonation.

‘Beside one of the many petrol tanks which are distributed over the whole corridor stands the petrol hand with a little hand-pump, by means of which he pumps the fuel into the “ready-use” tank placed rather higher up, near one of the side engines—a very tiring job, especially at a great height. Every man who meets us has a sort of gas-mask over his face, or a tube like that of a narghile connected with an oxygen tube, or, when the person can remain in one place, with an apparatus dropping liquid air.

‘In the rear engine gondolas two engines are running, which kick up such a row that, however loud one shouts, we cannot understand a word. When we ask a question of the Petty Officer on duty, bellowing into his ear, he only shrugs his shoulders and indicates by signs that he does not understand us. We can tell, though, by the sound of the engines that everything is all right, and we hastily leave the noisy spot. Even in the corridor hearing does not at first become normal, only after some minutes we are relieved of a kind of pressure in the ears.

‘Now, as the last point in our rounds, we seek the sentry in the stern cockpit of the ship. His position is between the elevators, right aft on a little platform looking out for aircraft coming up from astern. He, too, is connected with the pilot gondola by telegraph and telephone.

‘After an absence of more than three-quarters of an hour we return to the front gondola. Somewhat exhausted we report that everything has been found in order. In the wireless room all messages received are now examined—and now we have some grub. The thermos flask with hot tea is brought out, also some biscuits and chocolate. At great heights the stomach will not tolerate anything else, like ham sandwiches, for instance—a sickness resembling sea-sickness is very easily brought about. Therefore, as a rule, only the lightest food is taken.’<sup>1</sup>

One of the principal tasks of German naval airships was that of protecting the Helgoland Bight against attacks made by ships of the Royal Navy, and when the weather permitted several airships were patrolling always. Some of the duties performed during these patrols are described as follows by Kapitänleutnant Joachim Breithaupt:

‘Naval airships carried out patrols far and near over the English and Norwegian coasts in all kinds of weather. It seldom happened that English men-of-war were sighted. Only in stormy weather, when no German air opposition was to be expected, or on very foggy days, or at night, did the enemy venture out of his protecting harbours,<sup>2</sup> mostly in order to lay mine barrages in the Heligoland Bight.

‘The discovery of these was an important duty of the airships. When the

<sup>1</sup> Article entitled ‘Mit L. 54 über der Nordsee’ in *In der Luft Unbesiegt*.

<sup>2</sup> These statements are not quite in accordance with the facts as known to us.

sea was calm and the sunlight favourable, success could be reckoned on. Sometimes the kind of mine could be clearly distinguished, even the inscriptions were legible. We tried to sink single mines by machine-gun fire, but in the case of regular mine-fields, in which the mines were laid in two rows, in chess-board formation at a distance of about 50 yards from each other, the airship dropped little floating buoys with coloured marking flags and then called the mine-sweeping flotillas by wireless. Once, when during this combined operation with the mine-sweepers, they failed to read my searchlight signals, so I went down on to the sea with *L. 6*, took an officer of the flotilla on board, showed him the mine-field from the air by flying over it several times at a height of about 50 metres, and then put him down on the water again.

'These descents on the water can be made without difficulty on a calm sea with the necessary precautions. You sail low against the wind, stop the ship, and let it fall carefully into the water. From the lack of the cooling breeze the gas now becomes warm and the ship wants to rise. The sea anchor is brought out, and the boat-like gondolas are filled with water by means of pails to counteract by weight this tendency to ascend. Ascending is achieved by dropping ballast; the ship becomes lighter than the surrounding air and lifts itself off the water.'<sup>1</sup>

In the foregoing chapters some accounts have been given of many raids made by German airships over this country, and it is thought that a description of one such raid written by a commander who participated in it will be of interest. The one quoted below is written by one of their most experienced and able officers, Kapitänleutnant Joachim Breithaupt, and relates to a raid that he made on October 13, 1915, in *L. 15* in company with *L. 13*, *L. 14*, and *L. 16*. The bombs this officer dropped inflicted serious damage on the City of London, particularly in the neighbourhood of Aldwych, the Royal Courts of Justice, Lincoln's Inn, Holborn, Gray's Inn, and Hatton Garden.

The account reads as follows:

"The order was "Attack important points in Central England". Details were, as usual, left to the leader of the airships. Korvettenkapitän Strasser avoided giving more than general directions, for he knew, as an experienced leader, better than any one, how much the decisions of his Commanders depended on weather and on local conditions at the goal.

"On October 13, 1915, we steered over the Frisian Islands to sea, well away from the Dutch Islands to avoid an infringement of neutrality. On this day the fog was so thick that at a height of only 130 feet one could no longer see the ground. I, therefore, preferred to avoid the so-called "wash-house" and go above the clouds. Down below everything was dark; up

<sup>1</sup> *In der Luft Unbesiegt*, pp. 279-80.

above the brightest of sunshine! The ship steers a safe course between cloud masses of different heights, on which the golden sun is reflected.

'At 9.0 p.m. we are near the English coast—the weather has cleared. In the distance the white breakers and the rocky shores can be plainly seen. We take our bearings accurately, remain over the sea till it is quite dark, and then steer straight for our objective—London. On crossing the coast we are at once fired at briskly by the anti-aircraft guns, and searchlights are thrown on us.

'Over the land we fix our position from time to time by throwing out flares. (These are large tin cans filled with rockets and stars, which are set off by a time fuse. The lighting up of the airship is prevented by a screen.) Towards 10.0 p.m. we reach the Thames, easily distinguished by its characteristic windings; the last water-ballast is thrown out, so as to reach the greatest possible height; each man goes to his alarm post.

'London lies below us almost dark; since the last attack the English understand the value of screening their lights. Over the first houses in the suburbs the shooting becomes very troublesome. Before us lies, at between 6,500 and 13,000 feet, a broad, well-aimed barrage of bursting shells brightly illuminated by searchlights. I, therefore, prefer to attempt the attack from another side.

'Keeping well to the west of the sea of houses which can now be seen plainly, owing to the numerous searchlights, we steer straight over the suburbs to the City. It is an unforgettable picture, this bursting of shrapnel (sometimes unpleasantly close) and below the crashing of bombs and the roar of guns. Alongside us are the other airships, which are lighted up like ourselves by the searchlights, standing out plainly, and over us the starry heavens! But at such times one is not very susceptible to the beauties of Nature and her moods; it only comes back to one's consciousness later. Now we must concentrate all our attention.

'I should have liked to go higher up, but my ship would not—could not; we had counted on a much lower temperature, and the better carrying power of the air that goes with it. At noon, before starting, the ground thermometer showed 7° C., and at 11.0 p.m., at over 10,000 feet, it was still 3° C. In normal air strata the temperature decreases about  $\frac{1}{2}$ ° C. for every 100 metres height. We have, therefore, an unpleasant inversion. But I would not give up the plan of attack I had made, so the word was: "Stick to it and trust to your luck."

'It is easy to find the way. London lies beneath us like a lightened map. The Officer of the Watch, Oberleutnant Kuhne, aims through the pendulum-aiming telescope and releases the bombs. It would be a mistake to suppose that small, isolated targets could be hit. We dropped the bombs where they were certain not to fall in open fields, in parks, or into water. The machine-gunners are at their posts, the sailmaker<sup>1</sup> and the spare engineers look after the ship, so as to take the necessary steps at once in case of hits.

<sup>1</sup> The duty of this rating was to examine the gas-bags, to test the working of the relief valves, and to repair any shot-holes in the outer cover and/or gas-bags.

‘Conscious of the seriousness of the situation, every man performs his work silently. In such moments no orders can be given. Here each must think for himself, and all are united by a feeling of loyalty and confidence. My crew, from the Petty Officer Engineer to the stokers, consisted entirely of volunteers. These stout fellows had an inborn iron sense of duty and self-sacrificing devotion.

‘In the ship all went on without any trouble. I cannot tell what was the effect of the bombs, which started frequently large fires where they fell; but I should like to think that it was pretty warm down there. Perhaps our official reports obtained through news from spies were sometimes coloured. . . .

‘Thank God! We have passed the City. But suddenly a fresh murderous fire begins from a direction whence we did not expect it. At the same time enemy aeroplanes dart through the rays of the searchlights, beside us and over us, as we are informed by the look-out on the bridge of the airship through the speaking-tube. The tracer bullets fired by their pilots are easily seen, the slightest contact with which would set our ship on fire. But we are in luck once more! Star shells tear through the air, their parabola course can be traced as if on a drawing.

‘At last, after 40 minutes of exciting life, we are away from the “unfortified” City. Here and there a breath of relief is heard, all are conscious of having passed a crisis. Over the coast we are fired at again, but the ill-directed fire does not have any effect; how much better was the marksmanship of the London batteries! Our last bombs rush down as a parting salute, then we are over the sea, and soon 13,000 feet up. In consequence of the lightening of weight caused by the releasing of the bombs, the engines can drive the ship—now about 2 tons lighter—to greater heights. In the gondolas the electric lights are turned on, the “War Day Book” written up. The result of the voyage is reported to the Fleet by wireless. We steer for home by way of the Dutch coast.’<sup>1</sup>

No account, however meagre, of the activities of Zeppelin airships during the War would be complete without some description of the long flights of *L.Z. 120* and *L. 59*. The first of these ships was commanded by Oberleutnant d. R. Ernst A. Lehmann, her construction number was *L.Z. 90*, and, according to her commander, she ‘was about of the time and type of the naval *L. 35* to *L. 38*’. She was based on Seerappen for patrol duties over the Baltic. In the early summer of 1917 it was decided to make an endurance voyage in her, and to this end she was loaded with 2,700 lb. of bombs, 6,200 lb. of small arms supplies and spare parts, 7,700 lb. of water ballast, a crew of 28, and 20 tons of petrol and oil; in all her total load was almost 30 tons. She ascended with this cargo from Seerappen a few minutes before

<sup>1</sup> *In der Luft Unbesiegt*, pp. 292–6.

midnight on July 26 (1917) and remained in the air for 101 hours, until she landed at 4.40 a.m. on July 31; even then there 'still remained on board enough fuel for 36 hours more'.<sup>1</sup>

This trip paved the way to the voyage of *L. 59* cited above. In the autumn of 1917 the German troops under General von Lettow-Vorbeck were being hard pressed by British troops and were very short of stores, especially ammunition and medical stores. Suggestions were made to the German Admiralty that such supplies should be sent to them by airship, and, mainly as a result of the successful voyage of *L.Z. 120*, it was agreed that this should be done.

The German Admiralty decided that the journey to Africa should be made by *L. 57* with Kapitänleutnant Bockholt in command. After all the preparations for the journey had been made she was flown to Jöterbog. Just before she was due to leave for Bulgaria (the base for the proposed voyage) she made a trial trip but met very bad weather, and on coming in to land crashed and was wrecked, her remains being burnt in order to prevent any news of the proposed voyage being made public.

It was decided that her place should be taken by *L. 59*, then just on the point of completion at the Zeppelin factory at Staaken. In order to provide the necessary lift two extra gas-bags were inserted in this ship, which meant cutting her in halves and lengthening her by nearly 100 feet. This airship was remodelled, enlarged, and completed for her arduous journey *within four days*—October 31 to November 3, 1917—and the day after this she arrived at Jamboli, in southern Bulgaria, whence she was to start on her journey across Africa.

After some trials she ascended from Jamboli on November 31, with a load of 40.8 tons on board. She crossed the Aegean and Mediterranean Seas, passed diagonally across Egypt to the confluence of the Blue and White Niles, south of Khartoum, and, thereby having accomplished more than half her flight, was recalled by a wireless telegraphic signal from the German Admiralty and landed again at Jamboli without any difficulty.

*L. 59*, on this voyage, covered 4,830 miles in 95 hours, and travelled throughout the journey at a reduced speed. The German authorities calculated after this trip that, carrying a 15-ton load, she could have made the voyage from Germany to San Francisco without stopping. Had she arrived over the beleaguered Ger-

<sup>1</sup> For a detailed account of this flight vide *The Zeppelins*, pp. 235-41, and an article in *In der Luft Unbesiegt*, pp. 275-6.

man forces in East Africa, it was the intention to land at Makandi, having dropped previously some of the crew by parachute, in order to inform General von Lettow-Vorbeck's troops how to moor her.

Some idea of the activity of the naval airship branch can be gathered from the accompanying table on page 346, dealing with the work done on the station at Ahlhorn during the period 1916 to 1918.

The losses in personnel in the Imperial German Naval Airship Service were relatively very high. Next to their submarine Service they were the highest of all of the naval Services, for 74 officers, 264 non-commissioned officers, and 51 men were killed; the losses in officers alone represented about 42 per cent. of the total number in the Service. To these deaths must be added 32 officers, 106 non-commissioned officers, and 8 men who were either interned or wounded.

Of the 62 airships that were in commission during the War 22 were destroyed by the allied forces.

Whatsoever criticism may be levelled against the airship raids, there can be no question that the bravery displayed by the officers and crews of these ships was of the highest order, and, despite the heavy losses they incurred, the moral of the enemy airship Service remained unshaken to the end. German airship commanders have paid tribute, on many occasions, to the bravery of the pilots who sought their destruction, and it is felt that we, in our turn, should recognize them and their crews for what they really were—very able and very brave men.

LIST OF AIRSHIPS IN THE IMPERIAL GERMAN NAVAL AIRSHIP SERVICE IN COMMISSION  
DURING THE WAR 1914-1918

No. of Airship.	Date of Commissioning.	End of Commission.	Commander's Name.	Observation Officer's Name.	No. of War Flights made by her.	Total No. of Raids she took part in.	Total No. of Cruises made by her.	Fate of Airship and Crew.
L. 3.	In commission at the outbreak of hostilities, Aug. 30, 1914.	Nov. 17, 1915.	Fritz.	von Buttler. von Lyncker.	31	1	88	Caught in a snowstorm, ran short of petrol, and was wrecked off Fano, Jutland. The crew were interned.
L. 4.	Nov. 17, 1915.	Nov. 17, 1915.	Platen-Haller.	Petersen. Kruse.	12	1	40	Ditto.
L. 5.	Aug. 6, 1915.	Aug. 6, 1915.	Hirsch.	Wenke.	44	2	95	After a raid on Dünamünde was badly damaged and was forced to alight near Flensburg. As she was by then obsolete it was decided to break her up on the spot.
L. 6.	Sept. 24, 1914.	Sept. 24, 1915.	Boeker.	Frankenberg.	37	1	90	As a result of inexperienced handling of the gas plant was burnt in her shed at Flensburg, Sept. 19, 1916.
L. 7.	Nov. 3, 1914.	Sept. 19, 1916.	von Buttler.	Dietrich.	77	0	165	Afterwards used as a training ship. Shot down by H.M.S. <i>Galatea</i> and the submarine E. 37. Airship sank. Seven of her crew rescued and taken prisoners.
L. 8.	Dec. 18, 1914.	March 4, 1915.	Beelitz.	Freimel.	75	0	21	von Nathansius. Schüttitz. Rothe. Sonnenfeldt. Hempel. Gebauer. Wenke. Kuhne.
L. 9.	March 8, 1915.	Sept. 19, 1916.	Mathy.	Bräuhof.	4	140	While attempting a raid on England she met heavy weather and was shot down by Belgian gunners and crashed at Trelleborg. Destroyed by fire along with L. 6.	
L. 10.	May 13, 1915.	Sept. 3, 1915.	Loewe.	von Nathansius.	8	5	59	Afterwards used as a training ship. Schütze. Zimmermann. Rothe. Wenke. Sticker.

No. of Airship.	Date of Commissioning.	End of Commission.	Commander's Name.	Observation Officer's Name.	No. of War Flights made by her.	Total No. of Raids she took part in.	Total No. of Cruises made by her.	Total No. of (including training flights)	Fate of Airship and Crew.
L. 11.	June 6, 1915.	April 5, 1917.	von Buttbar. Schulze.	von Schiller. Mieh.	34	12	394	14	Having become obsolete was broken up in Hague.
L. 12.	June 21, 1915.	Aug. 10, 1915.	Petersen.	Brodrück.	6	1	160	Struck by gun-fire from guns at Langdon Fort, Dover. Came down at sea. Taken in tow by German destroyers, bombed but reached Ostende, and was dismantled.	
L. 13.	July 23, 1915.	April 30, 1917.	Mathy. Proch. Eichler. Schwander.	Freimel. Brand. Kohlhaus.	45	10	160	Having become obsolete was broken up in Hague.	
L. 14.	Aug. 9, 1915.	Nov. 8, 1918.	Flemming. Böcker. Manger. Dose.	Frankenberg. Gruner. Trübe.	57	15	546	Destroyed June 19, 1919, by the airship crews at Northolt.	
L. 15.	Sept. 9, 1915.	March 31, 1916.	Breithaupt.	Kuhne.	2	3	35	Struck by gun-fire from Purfleet. Also attacked by pilot of B.E. 2c, Second Lieutenant A. de B. Brandon, H.D. Detachment, No. 19 Res. Squadron, R.F.C. Came down at sea off Kentish Knock. Airship sank. Crew rescued and taken prisoners.	
L. 16.	Sept. 23, 1915.	Oct. 19, 1917.	Petersen. Sommerfeld. Gayer.	Brodrück. Gebauer. Denn.	50	13	250	Was badly damaged on landing by a crew in training and was wrecked.	
L. 17.	Oct. 20, 1915.	Dec. 28, 1916.	Ehrlich. Kraushaar.	Dietsche. Zimmermann. von Nathusius.	36	8	80	Burnt in the shed at Tondern. On entering L. 21 knocked against the corner of the shed, burst into flames, and the fire spread to L. 17.	
L. 18.	Nov. 3, 1915.	Nov. 17, 1915.	Dietrich.	0	0	0	4	As a result of inexperienced handling of the gas plant was burnt while being filled with gas at Tondern.	
L. 19.	Nov. 27, 1915.	Feb. 2, 1916.	Loewe.	Braunhof.	1	1	14	Forced to alight on North Sea on account of engine failure and damage done by gun-fire. Later sank with the loss of all the crew.	
L. 20.	Dec. 21, 1915.	May 3, 1916.	Stabbert.	Schirpitz.	8	2	19	After raiding Scotland, as a result of inexperienced navigation (lack of proper understanding of the weather conditions), was driven to Norway and forced to land through lack of petrol near Savanger. The ship afterwards sank and the crew were interned.	
L. 21.	Jan. 10, 1916.	Nov. 28, 1916.	Dietrich. Frankenberg.	von Nathusius. Schulz. Salbrunn.	26	11	74	Destroyed as the result of attack made of Lowestoft by Flight Lieutenant E. Cadbury R.N. and Flight Sub-Lieutenants G. W. R. Fane and E. L. Pulling of Great Yarmouth R.N. air station. All in B.E. 2c's.	
L. 22.	March 3, 1916.	May 14, 1917.	Dietrich-Bielefeld. Hollender.	Eisenbeck. Frey. von Knobelsdorff.	41	8	82	Shot down by machine-gun fire from large America flying-boat. Pilots: Flight Lieutenant C. J. Galpin, Flight Lieutenant R. Leckie. Crew: Chief Petty Officer V. F. Whitting and Air Mechanic O. R. Laycock, all of Great Yarmouth R.N. air station. Sunken in sea, in flames, off Tencelling.	

L. 23.	April 16, 1916.	Aug. 21, 1917.	von Schubert. Ganzel. Stabbert.	Rothe. Bockhold. Hannam. Dinter. Maas.	57	3	104
L. 24.	May 20, 1916.	Dec. 28, 1916.	Koch.	23	4	44	
L. 29.	Jan. 1, 1917.	Sept. 15, 1917.	Freimel.	Test cruises only.	39		
L. 30.	May 30, 1916.	Nov. 1, 1917.	von Buttler. Sommerfeld.	37	10	123	
L. 31.	July 17, 1916.	Oct. 1, 1916.	von Buttler. Freimel. Bodecker.	7	6	19	
L. 32.	Aug. 8, 1916.	Sept. 23, 1916.	Mathy.	4	3	13	
L. 33.	Sept. 2, 1916.	Sept. 24, 1916.	Petersen.	1	1	4	
L. 34.	Sept. 27, 1916.	Nov. 28, 1916.	Boeker.	von Nathusius.	5	2	11
L. 35.	Oct. 18, 1916.	Oct. 1916.	Dietrich. Ehrlich.	15	2	88	
L. 36.	Nov. 11, 1916.	Feb. 17, 1917.	<i>Afterwards used as a test ship.</i> Viktor Schulze.	Mieh.	0	20	
L. 37.	Nov. 27, 1916.	Dec. 14, 1917.	Eclier.	Brund. Jahn.	4	70	
L. 38.	Nov. 26, 1916.	Dec. 29, 1916.	Proess.	Eisenbeck.	1	0	12
L. 39.	Dec. 18, 1916.	March 16, 1917.	Koch.	von Colland.	3	1	23
L. 40.	Jan. 1, 1917.	June 6, 1917.	Sommerfeld.	Gebauer.	8	2	29
L. 41.	Jan. 1, 1917.	June 6, 1918.	Manger.	Gruner.	18	3	35
L. 42.	March 28, 1917.	Nov. 9, 1918.	Dietrich.	Eisenbeck.	74	4	69
L. 43.	March 15, 1917.	June 14, 1917.	Martin. Kraushaar.	Zimmermann.	7	1	14
L. 44.	April 5, 1917.	Oct. 20, 1917.	Slabbert.	Rothe.	12	4	26
L. 45.	April 7, 1917.	Oct. 20, 1917.	Kolle.	Schulze.	14	2	26

*(up to time  
the training  
flights com-  
mence)*

Shot down by machine-gun fire from Sopwith Pup flown by Flight Sub-Lieutenant B. A. Smart from the deck of H.M.S. *Yarmouth*. Sank in flames in sea off Lodbjerg (Denmark).

Went into the side of her shed while entering it at Tondern, and was destroyed, along with L. 17, by fire from the resulting sparks. Taken over by the Army as a trial ship. Being obsolete was broken up.

Until May 1917 stationed on the North Sea, then on the Baltic. After the cessation of hostilities in the Baltic was withdrawn and stationed at Seerappan. By the order of the Allies was broken up in the summer of 1920 and parts were delivered to Belgium.

Shot down by machine-gun fire from pilot of B.E. 2c, Second Lieutenant W. J. Tempest, No. 39 Squadron, R.F.C. Came down in flames at Potters' Bar.

Shot down by machine-gun fire from pilot of B.E. 2c, Second Lieutenant F. Sowrey, No. 39 Squadron, R.F.C. Came down in flames at Billericay.

Damaged by gunfire from the London defences. Also attacked by Second Lieutenant A. de B. Brandon of No. 39 Squadron, R.F.C., in a B.E. 2c. Came down only partially damaged at Little Wigborough.

Shot down by machine-gun fire from pilot of B.E. 2c, Second Lieutenant I. V. Poynt, No. 36 Squadron, R.F.C. Came down in flames in sea off West Hartlepool. Broken up Oct. 1918.

In consequence of inexperienced navigation was stranded near Rehben a. D. Aller and wrecked. Until July 1917 was stationed on the North Sea, then on the Baltic. After the end of the Baltic war was withdrawn and sent to Seddin. By the order of the Allies was broken up in the summer of 1920 and parts were handed over to Japan.

During an attempt to raid St. Petersburg was forced to land in bad weather owing to shortage of petrol, and because there was no possibility of a return journey was broken up.

On the return journey from a raid on England was brought down in flames at Compiegne by anti-aircraft gun-fire. As a result of faulty navigation was badly damaged, and was broken up.

From Dec. 9, 1917, she was a school ship till she was withdrawn from service. Afterwards destroyed by the airship crews at Nordholz, June 19, 1919.

From Jan. 7, 1918, she was a training ship, afterwards destroyed by the airship crew at Nordholz, June 19, 1919.

Shot down by machine-gun fire from large America flying-boat. Pilots: Flight Sub-Lieutenants B. D. Hobbs and R. F. L. Dickey. Crew: Air Mechanics H. M. Davis and A. W. Goody, all of Felixstowe R.N. air station. Came down in flames in sea off Vlieland.

On the return journey from the 'Silent Raid' on England was hit by the anti-aircraft guns at Vathmenil and fell to the ground in flames at Chenevrey.

On the return journey through lack of petrol in the valley of the Bueche (France). The ship was destroyed by the crew, who were afterwards captured.

No. of Airship.	Date of Commissioning.	End of Commission- sion.	Commander's Name.	Observation Officer's Name.	Fate of Airship and Crew.		
					No. of War Flights made by her.	Total No. of Raids she took part in.	Total No. of Crews made by her.
L. 46.	May 1, 1917.	Jan. 5, 1918.	Hollender.	Frey.	22	3	36
L. 47.	May 4, 1917.	Jan. 5, 1918.	Wolf, von Freudentreich.	Fischer.	21	3	45
L. 48.	May 2, 1917.	June 17, 1917.	Eichler.	Mietz.	2	1	10
L. 49.	June 15, 1917.	Oct. 20, 1917.	Gayer.	Dehn.	3	1	15
L. 50.	June 18, 1917.	Oct. 20, 1917.	Schwander.	Westphal.	7	2	19
L. 51.	July 26, 1917.	Jan. 5, 1918.	Dose.	Trude.	4	1	20
L. 52.	July 24, 1917.	Nov. 9, 1918.	Fritsch.	Berger.	21	1	37
L. 53.	Aug. 21, 1917.	Aug. 11, 1918.	Proess.	Brandt.	23	4	53
L. 54.	Aug. 26, 1917.	July 19, 1918.	Bockholt.	Maas.	16	2	52
L. 55.	Sept. 8, 1917.	Oct. 40, 1917.	Flemming.	Kohlauer.	1	1	12
L. 56.	Sept. 28, 1917.	Nov. 9, 1918.	Upmeyer.	Stelling.	18	1	44
L. 57.	Sept. 25, 1917.	Oct. 7, 1917.	Maas.	Zaezschmar.	0	0	4
L. 58.	Nov. 4, 1917.	Jan. 5, 1918.	Arnold Schultze.	Bockholt.	4	1	14
L. 59.	Nov. 3, 1917.	April 7, 1918.	Liesemann.	Grusendorff.	2	0	18
L. 60.	April 2, 1918.	July 19, 1918.	Flemming.	von Kruse.	12	1	23
L. 61.	Dec. 19, 1918.	Nov. 19, 1917.	Ehrlich.	Dietsch.	11	2	39

I. 62. Jan. 29, 1918.	May 10, 1918.	Manger.	Gruner.	4	2	20	Shot down by machine-gun fire from large America flying-boat F. 2a. Pilots: Captains T. C. Patterson, R.A.F., A. H. Munday, R.A.F. Crew: Sergeant H. R. Stubbington, R.A.F., Air Mechanic Johnson, all of R.A.F. station, Killingholme. Came down in flames in sea off Heligoland. Destroyed on June 19, 1919, by the airship crews at Nordholz.
I. 63. March 10, 1918.	Nov. 9, 1918.	von Freudentreich.	Korstmann.	19	3	39	
I. 64. March 13, 1918.	Nov. 9, 1918.	Arnold Schütze.	Liessmann.	14	1	20	
I. 65. May 3, 1918.	Nov. 9, 1918.	Frey.	Trube.	10	0	29	Handed over to England July 22, 1920.
I. 70. July 8, 1918.	Aug. 6, 1918.	Vernuchen.	Dose.	2	1	7	Destroyed on June 19, 1919, by the airship crews at Nordholz.
I. 71. July 10, 1918.	Nov. 9, 1918.	won Lossnitzer.	von Krüger.	0	0	8	Shot down by machine-gun fire from D.H. 4, Pilot Major E. Cadbury, R.A.F., Observer Captain R. Leckie, R.A.F., both of Great Yarmouth air station. Sank in flames in sea off Walls-next-the-Sea. Handed over to England June 30, 1920.
I. 72. —	—	Dietrich Bielefeld.	Eisenbeck.	—	—	—	Not completed at the time of the German Revolution 1918. Handed over to the French Government. Renamed the <i>Drimus</i> . Lost with all hands over the Mediterranean in the autumn of 1923.
<b>Total 62</b>							

#### ANALYSIS OF LOSSES

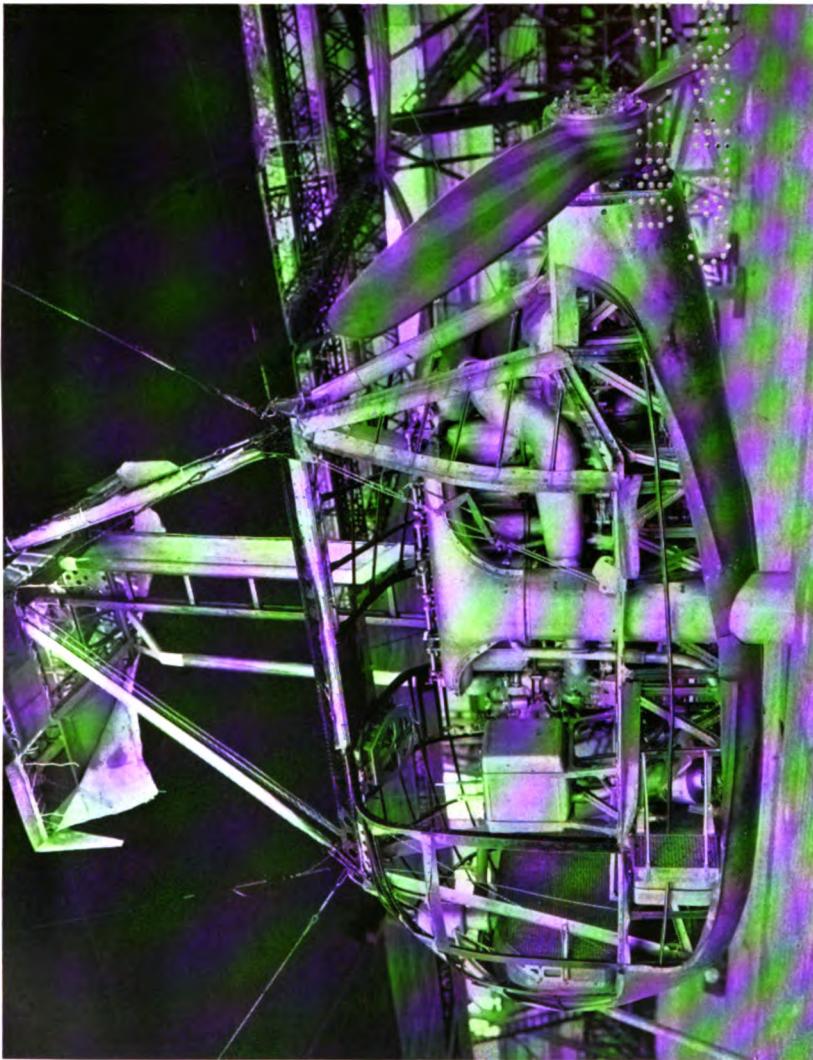
(1) Accidentally destroyed in their sheds	9
(2) Struck by lightning	1
(3) Wrecked as a result of bad weather	10
(4) Shot down by anti-aircraft guns	7
(5) Shot down from land machines	3
(6) Shot down from flying boats	0
(7) Shot down from seaplanes	1
(8) Shot down from machines flown from aircraft-carriers	1
(9) Shot down from machines flown from lighters	1
(10) Bombed in their sheds	2
(11) Forced to land by aircraft	1
(12) Accidentally destroyed by fire when in flight	1
(13) Broken up deliberately	5
(14) Wrecked on landing (by training crews)	1
(15) Deliberately destroyed by their crews to avoid surrendering them	7
(16) Surrendered in accordance with the terms of the Treaty of Versailles	6

Total

62

STATISTICS OF AIRSHIP JOURNEYS MADE BY THE SHIPS STATIONED AT AHLHORN \*

<sup>1</sup> Lost or destroyed.  
At Althorn there were stationed 25 airships (23 Zeppelins and 2 Schütte-Lanz airships). The following airships also landed there: L. 11, L. 14, L. 16, L. 21, L. 25, and P.L. 27.



ONE OF THE ENGINE CARS OF *L. 70.*

36  
35  
34  
33

## XX

### THE EVENTS AT GREAT YARMOUTH AIR STATION DURING 1918 UP TO THE FORMATION OF THE ROYAL AIR FORCE

PROBABLY the most important event during the January of 1918 which directly concerned Great Yarmouth air station was the disastrous explosion which occurred on the afternoon of the 5th at the Zeppelin airship station at Ahlhorn. Just before dusk, when the workmen were streaming out of the sheds, 'a flame blazed suddenly upwards from No. 1 shed. A gigantic pillar of fire burst through its roof and then, like lightning, rushed up into the evening sky.' The airship *L. 51* had, by some means, caught fire; this conflagration was followed a few seconds later by further explosions, with the result that, within the space of a few moments, the whole station was wrecked. Very severe damage was done to the neighbouring villages and five airships were destroyed—the Zeppelin airships *L. 46*, *L. 47*, *L. 51*, *L. 58*, and the Schütte-Lanz *S.L. 20*. Accounts differ as to the extent of the casualties among the personnel—one states that 15 were killed, another that 21 were killed and 30 severely injured, while yet another maintains that 12 were killed and 106 injured.<sup>1</sup>

The cause of this disaster has never been discovered. Some German authorities believed that 'the working party on *L. 51* were cleaning and overhauling her. In the aft engine car the engine was being swabbed down with petrol. An electric light was needed and was switched on, but the insulation was badly worn in one place, some petrol accidentally fell on this place, and the next minute the whole car was a mass of flames—and then the whole ship went up.' Other authorities believed that it was an act of sabotage, and during 1928 a German was the victim of rumours which associated his name with the act of deliberately setting alight one of the ships, for which 'he received £100,000—"Judas money"—from England to commit this crime against his country'; but as stated the reasons how and why this explosion occurred have never been traced.

The effect of this calamity on the operations of Great Yarmouth

<sup>1</sup> For a detailed account of this disaster vide *Zwei deutsche Luftschiffhäfen des Weltkrieges, Ahlhorn und Wildeshausen*, pp. 213-29.

The loss of the airships was undoubtedly a very serious one for  
the German Navy, although five new airships were commissioned  
before the Armistice; but the loss of the sheds was never made  
good.

During the night of January 14 Great Yarmouth was shelled  
for the third and last time by what proved to be enemy naval  
forces. Shortly before midnight, when a heavy gale was blowing  
and in the midst of a blinding rain squall, the inhabitants of the  
town were awakened by the noise of gun-fire at sea and the  
bursting of shells in and around the town. It appeared eventually  
that some enemy destroyers had eluded our patrols and appeared  
off the town, which they shelled for a few minutes, then turned  
about and steamed back into German waters. These ships were  
not brought to action by our own naval forces, and the weather  
prevented any attack by machines from the air station. Several  
officers of the air station had narrow escapes from being killed  
in their beds, but the general attitude towards the bombardment  
was expressed by one of their number, who said that 'people  
annoy me by talking rot about the brutality of the enemy bom-  
barding "open towns". Yarmouth—apart from being an im-  
portant mine-sweeping port and air station—is stiff with troops  
and guns—about 11,000 of the former, so rumour hath it.'

During this month continual patrols were made by flying-boats,  
whenever possible, from the air station to the western edge of  
the Frisian coast, and these usually lasted about 6 hours. The  
strain on their pilots was very great. The physical exertion in  
handling the machines and the nervous strain in navigating them  
in weather which was generally bad (also, once the War Channel  
shipping was left behind, there was not another ship to be seen till  
Holland was reached) undermined the health of the pilots, and it  
was found that about two, or at the most three, a week of such  
patrols was all that they could stand. The result of exceeding this  
number is told in an extract from a letter written at the time by  
one of their brother officers:

'Poor Galpin properly done in. I do not suppose he will fly again for  
6 months at least. Trips of 6 to 8 hours at a stretch seem to do a lot of  
pilots in, Hards, Galpin, Leckie being three among many that have tem-  
porarily or permanently been knocked out from this station. In France  
a flight seldom lasts over 3 hours for the majority of pilots, usually about

1 or 2 hours. Here, these people generally do 6 to 7 over a barren and sullen sea, where engine failure does not mean imprisonment, however disagreeable that may be, but starvation—frequently followed by death.'

It must not be thought from this remark that it was the general opinion of pilots and observers of the Royal Naval Air Service that their work was more hazardous than that of their brother officers of the Royal Flying Corps. Very far from it. They realized that, except in the case of the naval squadrons operating in France, they ran a much and disproportionately smaller chance of being killed or wounded in aerial combat than did the officers of their sister Service. Yet the latter were generally spared the awful death of those who, generally through some trivial mechanical defect, were forced to alight on the sea and were never seen or heard of again. Such was the fate of Flight Sub-Lieutenant Morris who, on January 27, left the air station in a thick fog, flying in a Schneider seaplane. Despite a wide search he was never seen or heard of again, although the smashed remains of his machine were found by an armed drifter the day afterwards.

The experiences of the officer and rating who were adrift for 5 days on a seaplane float, and those of the crew of the flying-boat 8666, may be taken as examples of what was suffered by those who were not saved.

On the last day but one of the month (January) it was decided to send a flying-boat on 'a special long-distance reconnaissance patrol to Terschelling area', and, accordingly, early that morning H. 12, N. 8666, with Flight Commander F. W. Walker, D.S.C., Flight Lieutenant E. A. Bolton, and Petty Officer Thompson (wireless telegraphist) and Leading Mechanic Crook (engineer) on board, left the Roads in accordance with instructions. Bolton subsequently described their adventures on this patrol as follows:

'At the beginning of 1918 there were only two qualified "First Boat pilots" on the station, namely, Leckie and Fetherston. At that time, also, there were only two "Second pilots", Galpin and myself. Leckie and Galpin were one crew, and Fetherston and I the other, and we took it in turns to be the "duty crew" for the day. About this time, Livock and Walker, who were both Flight Commanders, managed to get sent on a "First pilots" qualifying course to Felixstowe. Walker, hitherto a land-machine pilot, returned first, and as I was the only "Second pilot" available, I was allotted to take care of the navigation on his maiden effort. We were detailed for an Admiralty reconnaissance of Terschelling area in H. 12, 8666.

'We started at 10.45 a.m., on January 30, a glorious day with a light

350 GREAT YARMOUTH AIR STATION DURING 1918 UP TO  
south-easterly wind and a calm sea. We got off all right and proceeded east for 40 miles, when the oil pressure in the starboard engine commenced to drop rapidly. We turned about for Yarmouth, but when we were still 30 miles to the east the starboard engine seized, smashing the crankshaft.

'Heavily laden, we gradually lost height, flying with the remaining engine. When about 15 miles out we had only 100 feet of height left, and, as we spotted a fleet of trawlers, we landed, making a good landing in a calm sea. We were then taken in tow by H.M.S. *Glowworm* (Commander Eyres Monsell) and arrived back at Yarmouth at 2.0 p.m.'

Misfortune dogged this particular patrol, for on three further occasions it was attempted, and each time mechanical breakdowns or inherent weakness in the design and construction of the machines prevented its completion. The story of these failures is given, because it illustrates the bearing of such defects on aerial operations. On February 3 the same patrol was attempted in another H. 12—N. 8692 (having been essayed previously on January 31 and February 1 and 2)—but

'owing to the heavy swell running at the time, the boat commenced to bounce badly when taking off, and finally got out of control. On the third bounce she broke her back, and all the engine controls were carried away. She then rose to about 50 feet and did a side-slip nose-dive into the water with both engines full on. The boat was completely wrecked, breaking into three pieces, and immediately commenced to settle. The W/T operator<sup>1</sup> got caught in the wreckage, but we managed to free him, and no one was badly hurt.'

With the ever-present menace of being compelled to alight, through various causes, far out to sea, it is not surprising that pilots devoted a considerable amount of their time and ingenuity to the production of devices whereby they could ensure that news of their misfortune could reach the authorities. At the air station Flight Commander Walker had proposed for some time that all flying-boats should carry a box-kite and a spare aerial, so that, in the event of the pilot having to alight, he could fly the kite, using the cable as the aerial, and so get into communication with the air station. As not unusual in such cases his brother officers rather derided the proposal, but its sponsor was soon to prove the value of the suggestion.

The first of the F. 2a flying-boats arrived at the air station during the first week of February, and, with one of them—N. 4511—Flight Commander H. Stewart and Flight Lieutenant Bolton tried again on February 5 to patrol to Terschelling. Misfortune

<sup>1</sup> Air Mechanic Henderson.

befell them once more, for, while they 'were taking off the petrol pipe became partially choked'. They repaired this defect and 'got off on the second attempt', but when they 'had risen to about 60 feet, the fabric stripped off one of the blades of the starboard propeller, causing excessive vibration', but they 'managed to make a fair landing'.

The recountal of their troubles serves to show how vitally necessary it is for machines to be kept in the highest state of mechanical efficiency. During the summer of the year under review flying-boats from Great Yarmouth and Felixstowe air stations were robbed of complete success when engaged with some enemy seaplanes, because the numerical superiority of the former was destroyed, due to machines having to alight because of broken petrol pipes.

On the 16th of this month (February) Flight Commander Walker, along with Flight Lieutenant Bolton and two ratings, Leading Mechanic Walker and Air Mechanic Henderson, set off in F.2a, N.4511 to attempt once more the patrol to Terschelling. An hour after they left the station 'both engines gave trouble, owing to the filter in the gravity tank becoming clogged'. Shortly afterwards 'both engines failed completely. Forced to land. Sea too rough to taxi, so let go sea anchor.' Thereupon, in Walker's words:

'By means of a 5-foot linen box-kite and spare aerial with which I had been experimenting at Yarmouth, we were able to get into and keep into constant wireless communication with Yarmouth. As the result of directional cuts obtained by Lowestoft, Flamborough Head, and Westgate, on these signals, our accurate position was given to the patrol boats searching for us, and we were picked up by H.M.S. *Glowworm* at 5.45 p.m., 8 miles down wind from the position she was given.'

Had they not been able to establish communication in this way they almost certainly would have been drowned, for a heavy gale sprang up and the air station had not picked up their call for help as they were descending. After the machine was taken in tow at a speed of 4 to 5 knots 'she broke adrift at 11.05 p.m.', owing to the heavy sea that was running, 'the keel plate tearing away from boat with about 2 feet of keelson. Strenuous efforts were made during the night to secure her again, but owing to the wind having increased to gale force these were unsuccessful, and boat sank at about 5.0 a.m. this morning.'

Speaking of this patrol Bolton said subsequently: 'The patrol

352 GREAT YARMOUTH AIR STATION DURING 1918 UP TO  
was still not done after the fourth attempt; the very devil seemed  
to have got hold of it. On the fifth attempt it was done, however,  
by Leckie and Livock on the 17th, and Leckie and I went across  
again on the 19th.'

As a considerable portion of this story will be devoted henceforth to an account of the work done by the F.2a flying-boats attached to the air station, it is felt that the following account of a typical patrol made in such a machine, written by one of their pilots,<sup>1</sup> will be of interest:

'The large flying-boats, weighing as they did just over 5 tons, and having engines developing 700 b.h.p., needed, as can be understood readily, skilful and experienced handling, not only in the air, but particularly when on the water, especially while they were attaining their flying speed. The chief difficulty, therefore, was the supply of experienced seaplane pilots to whose care these boats could be entrusted with reasonable safety, and it was found that the usual period taken from the commencement of flying to the efficient command of a boat was about a year and a half, and no officer was allowed to turn over to flying-boats until he had flown at least 100 hours in float seaplanes. Senior officers were always willing to serve under their juniors, in order to gain experience in boat work, and this enthusiasm was shared by all officers and men, whether of the flying or ground staff. The flying-boats were units of the fleet, and did their share in the patrolling of the North Sea, and particularly of the enemy's waters in the Bight of Helgoland.

'When not in use, the boats were kept in sheds ashore on trolleys or cradles, especially shaped to fit the bottoms of the hulls. On orders being received for patrol, the boats were wheeled to convenient positions near the top of the slipway, a working party of about 20 men being required for this job. The wheels of the trolley were chocked up and the engines started and allowed to "tick over" for about 10 minutes or so, to warm up gradually. Each engine was then tested to its maximum revolutions for a few seconds in order to ensure as far as possible that it was in perfect condition for the arduous work they were about to undertake. During this time, each member of the crew was looking after his own job and making sure that he had on board everything that was needed—ammunition, wireless gear, batteries, Aldis lamps, sea-anchor and ropes—while the pilots gave an eye to the controls, drinking-water, emergency rations, and carrier pigeons.

'All being found correct, the boat was wheeled to the top of the slipway and a cable from the winch made fast to the trolley. This controlled the speed of the boat down the slipway and prevented her from running away. She was steered straight by men pushing on either side of the tail portion of the hull as required, and a few feet from the water the boat was brought to rest to await the hand signal of the first pilot to let go, the second pilot having

<sup>1</sup> Flight Lieutenant E. A. Bolton.

taken up his position in the forward cockpit by the "quick-release-from-the-trolley" fitting.

"Everything now having been found satisfactory, the pilot waved his hand, the winch was freed, and the boat, by its own weight, ran down the few remaining feet into the water. The engines were slightly accelerated, driving the boat and the trolley deeper into the sea until the boat, by its buoyancy, lifted from the trolley. The second pilot pulled the release line at the same time, holding up his hand to show that the boat was now free. With another touch of the throttles the boat glided away from the slipway and taxied slowly along the water until the desired position for the "take-off" was reached. This journey may be anything from 100 yards to a mile or a mile and a half, according to the direction and strength of the wind, but rarely occupied more than 3 or 5 minutes at the most.

"A seaplane or flying-boat should always be taken off directly into the wind, or serious complications may arise, especially if the sea be rough. The unfortunate pilot finds himself describing a large circle on the water and finishes with the machine pointing in the opposite direction to that intended —a most mortifying state of affairs. This, however, is allowed rarely to occur, as the pilot usually takes good care to allow the boat to settle into the wind before attempting to get off. Theoretically speaking, if the engines are opened to full throttle, the boat will surge forward, rapidly gaining speed and gliding smoothly along the surface of the water until flying speed has been reached, and then a gentle pull on the elevator control will take the boat into the air. In the North Sea this may happen once or twice in the year, but on all other occasions the surface of the sea resembles that of a well-ploughed field with furrows several feet deep. Over this surface a speed of 60 knots must be attained, and water, when struck at a high speed, is an exceedingly solid substance. "Taking off" in a rough sea with a heavily laden boat is a most difficult operation and calls for considerable skill and experience on the part of the pilot. Let us describe how he does it.

"He takes a last look backwards and roars out: "Stand by!" His voice is rarely heard, but the crew know from sore experience that at this moment it is advisable to hang on tightly to the most solid portion of the boat. The throttle levers are pushed forward. The engines roar, and as the boat surges forward the elevator control is pulled back in an endeavour to lift the bow as high out of the water as possible. As soon as the boat reaches a speed of 15 knots, which is practically immediately, the pilot depresses the elevators, so lifting the tail portion and bringing the boat into horizontal flying position on the forward step. All this is only a matter of seconds. The air-speed indicator shows 20 knots, and now the hardest portion of the task commences. The wave tops begin to smash against the bottom like continuous hammer blows, increasing both in rapidity and intensity as the forward speed of the boat grows greater, and so severe are the shocks that it is impossible for any one to stand without holding on to something securely.

"Until an air speed of nearly 60 knots has been attained, the pilot must keep the boat on the surface, because if she is flung prematurely into the air

without attaining flying speed she will fall again to the surface with a crash quite liable to stave in the bottom planks and cause a complete wreck, perhaps even loss of life—there are 5 persons on board. At this time, more than any other, the first pilot feels his responsibilities; he strains hard at his elevators to hold the boat level as she roars onwards smashing through the wave tops ever gaining speed. All the time he must be watching, instantaneously ready to check the tendency of the taller waves to fling her from the surface, and of the deeper wave troughs to deflect the bows downwards. At this terrific speed she must not be allowed to bury her bows into the sea. All the time he glances continually at the needle of the air-speed indicator as it creeps round the dial. What a time it seems to take to gain the necessary speed—30 knots—40 knots—50 knots!

‘He eases the control wheel backwards and pulls on the elevators; with a last quivering blow the boat leaves the water and takes the air. She is flying and the rest is comparatively easy. Only 45 seconds have elapsed since the pilot gave the warning to “stand by”, but never has his judgement to be so accurate and unerring as during this short period. Owing to the size, weight, and enormous power of a flying-boat, and her complete frailty when contrasted with other forms of high-speed sea-craft, a complete wreck will almost certainly follow even a slight error of control when taking off.

‘In another 45 seconds the altimeter shows 1,000 feet and the engines are throttled from 1,800 to 1,600 revolutions a minute. At a height of 1,500 feet the engines are further throttled to 1,400 revolutions and the boat is swung to her eastward course for Holland, and, at a speed of 65 knots, disappears into the mist.

‘During the first few minutes of the flight the pilot occupies himself in trimming the boat by adjusting the controls. This is done by attaching to the elevator and rudder controls strong strands of “Sandow” elastic and so stressing them that the boat will fly level and straight. This relieves the pilot of much heavy work during the usual long flights of about 7 hours’ duration. During this time also the wireless operator unwinds the aerial and adjusts his set. After about 20 minutes, the Smith’s Knoll buoy is abeam, and a rough bearing, taken while passing it, enables the navigator to check his calculations as to the effect of the speed and direction of the wind on his course. The English fishing-boats are usually seen in this locality, and then nothing but 100 miles of sea and sky until the Dutch fishing-vessels are sighted round the Haaks light vessel, some 30 miles from Holland. The whole of this area is out of the radius of action of any German seaplanes, and the observation is, therefore, chiefly concentrated downwards for enemy submarines and surface craft, either of which are rarely seen in this well-patrolled area.

‘As the Haaks light vessel is approached, the course is altered north for Terschelling Island, and, because enemy seaplanes in superior numbers may now be sighted at any moment, the first pilot orders the crew to “Action Stations”. The wireless operator leaves his instruments and clammers into the forward cockpit. The second pilot’s controls are connected, and this

pilot now stands continually on his seat by his gun. The engineer leaves his petrol tanks and goes into the aft cockpit. The side ports are uncovered and both machine-guns got ready to be swung outboard at a moment's notice. The gun-layer takes up his position on the small companion ladder by the top aft gun. All guns and sights are finally examined, and from now onwards the most careful look-out is kept both fore and aft, as the first law in air fighting is not to be the victim of a surprise attack. Events move so rapidly that the damage is done, probably irretrievably, in a few seconds. The first pilot helps in the general look-out, or, if in a squadron, he keeps a careful watch on his leader for manœuvre signals, on the prompt and accurate execution of which so much may depend.

'For two hours now the F. 2a has been cruising off Borkum Island and the mouth of the Ems River, and in this short period well over 2,000 square miles of enemy waters have been thoroughly searched for enemy surface craft, but the enemy are not moving any of their large ships, nor, apparently, are any such moves contemplated in these waters, as no mine-sweeping preparatory to such movements is being done.

'During the whole of this time the coast of the Frisian Islands has been visible to starboard—sometimes in detail—a glorious sight in the sunshine at high water with the Zuyder Zee behind them—at other times, from afar, it is seen only as a low, dark, and unfriendly line.

'Here, alone, 200 miles from our base, one realizes that there is "a war on", and the look-out has to be exceptionally keen, as from experience the Germans deem it advisable to patrol in large numbers against the boats. Perhaps we were lucky in our comings and goings, because, in spite of our activities, it was seldom the enemy found us. They had a difficult task as our reconnaissances were made as irregularly as possible, both in courses and times.

'At last the course is altered north for 30 or 40 miles, bringing the area of the South Dogger Bank under observation. There is little likelihood of enemy surface craft being found here, and, as usual, all that can be seen is an empty horizon—nothing but sea and sky. West then, for 100 miles and then—west-south-west for home.

'Once again, when well on the westerly course, the danger zone of enemy aircraft is past, and the crew resume their normal stations. Four and a half hours have passed, and one realizes that the North Sea air is appetizing, so good use is made of the steaming cocoa that has been brought in "Thermos" flasks, the sandwiches, and chocolate.

'There is now no object in keeping the wireless silent, for, as far as the enemy is concerned, the patrol is over, and if the weather is bad the first pilot will probably decide to ask Yarmouth for a weather report and also a check on his position. When long-distance patrols are out, the direction-finding stations at Flamborough Head and Lympne are warned, and immediately naval aircraft signals are heard, both of them ascertain the direction relative to themselves. These bearing lines are set down on a chart, and the point where they cut is the position of the boat, so that, within ten minutes

‘For the last hour and a half nothing has been seen but sea and sky, and not for another hour is there much chance of the monotony being broken. At last the anxiously-sought dark line appears on the horizon and, although still 15 or 20 miles from Yarmouth, every one feels at home. In a few minutes more the Haisborough light vessel is sighted to starboard, and the wireless operator taps out his last signal: “Am flying in sight of land. Nothing more coming.”

‘He then winds in his aerial and collects his code-books. The gun-layer relaxes his vigilance and closes the side doors. The engineer pokes his head out of the hatchway and takes a last look at the engines. The second pilot folds down his controls, while the first pilot brings the boat down to 1,000 feet and flies over the air station to have a careful look at the “sausage” to confirm the wind direction. It is still westerly.

‘Out then to the Saint Nicholas light vessel, a mile and a half from the shore, and then, turning the boat head into wind, the pilot throttles down his engines and at the same time pushes forward the elevator control. The downward glide has commenced and the air speed is kept about 60 knots. Six hundred feet, 400 feet, and lastly 200 feet show on the altimeter. The pilot concentrates his gaze on the water. The sea rushes up to meet him. At about 15 feet the wave tops become distinct, so the downward angle is gradually lessened until the boat is skimming the water a few feet up. Losing speed, she sinks slowly lower and as she does so the pilot allows the bows to come up until she is in landing position.

‘At last a tap on the bottom. The water has been touched. A slight bounce, and then again she touches, this time to stay. The second step cuts the water, the boat surges into the sea and cocking up her bow comes practically to rest. The flight is finished and the engines are stopped. The pilot, his work over, fastens the controls, stretches himself, and, standing on his seat, gazes on the scene around. The second pilot goes into the forward cockpit, ready for the arrival of the attendant motor-boat, which, passing close across her bow, allows one of her deck hands to throw him a towing line, which he makes fast to the boat.

‘Near the slipway the crew are taken off in a dinghy, and with the “boom-boom-boom” of the synchronizing of the engines still in their ears, they go to their quarters, glad to rid themselves of their gear. The first pilot goes to the Commanding Officer and makes his report, which is telephoned forthwith to the Admiralty, and that night confirmed in writing with full details of the courses and the times. The value to the Admiralty of this patrol, with its apparently negative information, lies in the fact that we are sure that there are no enemy surface craft on the 8,000 square miles of the North Sea which has been under the observation of five look-outs during this patrol.

‘Although the crew have finished with the boat, the Duty Officer, motor-boats, and working party are only just starting. Getting a boat ashore was

no enviable task if there was even a light swell, but with a cross tide of 6 knots over the slipway—as there frequently was at Yarmouth—it was a very difficult job. Lines were made fast to the wing tips and thence through blocks on two mooring buoys on either side of the slipway to the shore. The boat was thus held stern first to the shore and a line was made fast to the tail portion of the boat and passed to a working party on the slipway. The trolley was made fast to the winch by a steel hawser and lowered down the slipway to the water's edge. By slackening on the wing-tip lines and hauling in on the tail line the boat was brought gradually nearer to the slipway. The waders, clad especially for the occasion, pushed the trolley further down the slipway into the sea. The tide frequently caught it and carried it to the side. The work was hard for them—almost armpit deep in the water—and if the trolley went over the edge of the slipway it had to be retrieved before another start could be made. The waders had one of the worst jobs at a seaplane station, and they were very "stout fellows", for imagine this job, at night, in winter, in a four-foot sea (no uncommon thing at Yarmouth) and a cross-wind, both of which rocked the boat in all directions.

'Now, bit by bit, the boat is coaxed nearer to the trolley. The Duty Officer watches the situation anxiously, lest damage be done to the boat, and bellows out his commands in the rising wind to the various portions of his working party: "Haul on the northern wing tip."—"Let go south."—"In a little."—"Steady"—and to the waders: "Now be careful. Don't let her bump." The trolley is under and the boat nearly on, and for the next few minutes the anxious part of the job proceeds. At last the waders have the boat bottom located correctly—"Haul away on the winch."—"Let go the wing tips"—and as the winch hawser takes the load the dripping machine is hauled out of the sea. Safe on the slipway, she is drawn to the "concrete" in front of the sheds. The winch cable is "let go" and the working party manning the trolley wheel the boat into her position in the shed.

'Even yet all is not done. The petrol party arrive. There are 300 gallons to be sieved through chamois leather into her empty tanks, for the petrol is poured through the leather to prevent any water from getting into the petrol tanks, because failure of the petrol system in rough weather might easily result in the total loss of the boat at sea.

'A party of engineers look to cleaning the petrol and oil filters—the magnetos and valve springs are overhauled. Aircraft riggers run over the controls, examine the wires, the fabric, and the fittings. Armourers look to the guns, clean them, and replenish the ammunition trays. The working party wipe down the hull and clean the inside of the boat.

'One or two hours later the shed doors clang. The Duty Petty Officer reports to the Duty Officer—"Everything all correct, Sir."—"Thank you—is everything ready for the dawn patrol?"—"Yes, Sir."—"Then you may dismiss the working party—Good-night."—"Thank you, Sir—Good-night."'

From this account some idea will be gathered, perhaps, of the essential difference between the daily work necessary on a seaplane and on a land-machine station. This may be summed up, although inadequately, by stating that it was absolutely necessary for the personnel at an air station of the former class to acquire a 'naval sense' in addition to a 'flying sense'.

When the weather allowed, and the flying-boats were in constant use during the day, they were moored out to buoys in front of the air station. This was not a regular practice, firstly, because of the liability to a sudden change in the weather which might cause the machines to break or drag their moorings, and so be driven ashore or out to sea; and, secondly, the hulls, being built of wood, soaked up a considerable amount of water, which reduced, of course, their useful carrying load. This inability to remain at their moorings had a further disadvantage in that large numbers of men were required to launch and bring them ashore—all of which resulted in a waste of 'man-power'—and there was always the risk of machines being damaged during these operations.

It was found difficult to devise a satisfactory system of mooring, for, while flying-boats could exert an astonishing pull on moorings even in a slight breeze (they have been known to soar at them in a high wind), the use of large buoys was found to be undesirable, on account of the danger of the hulls being stoved by contact when bumping. At the air station, after a considerable amount of experiment, it was found that the most satisfactory method of laying out such moorings was as follows. A large canister buoy was laid down with a 10-cwt. mushroom sinker, and through the ring of the buoy a light wire strop, about 3 fathoms long, was rove. The spare end was fastened to a small and light steel buoy. Those used by the Germans to mark their minefields were employed for this purpose, for they were washed up daily on our shores; empty petrol cans were used also. A light grass line was fastened to the wire strop for attaching to the snap hook secured to the bow of the flying-boat. This line was kept afloat by means of fishermen's net corks tied to it.

The flying-boats were towed by motor-boats, of which the most general type in use was 35 feet in length, equipped with a 60 b.h.p. engine and with a designed speed of 16 knots. They were manned by ratings amongst whom were ex-naval seamen and local fishermen all of whom had joined the Motor-boat Section of the Royal Naval Air Service for the period of the War.

The towing and handling of flying-boats was not an easy task,

for their submerged area was much less than the area exposed to the wind, so that they tended to sheer violently. Generally speaking, it was found better to tow them from an amidship rather than from an aft bollard. The lack of fast motor-boats was a drawback, in that flying-boats of the 1917-18 period covered a considerable distance before they left the water, and, during this time, were likely to crash when bouncing. The motor-boats had only about a quarter of their speed, and so could not keep up with them. On more than one occasion the officers and crew of such machines were nearly drowned through the hull splitting and sinking as a result of a heavy bounce, and the motor-boats, being, perhaps, a mile astern, were unable to reach the wreckage quickly enough.

During the last week of February three long patrols were made by flying-boats from the air station. On the 17th Flight Commander Leckie, with Flight Commander Livock and a crew of two, made a 'special reconnaissance to Texel' of 4 hours in the H. 12, N. 8666, but nothing of interest was seen, with the exception of 'three ships, two of which were paddled and flying the Red Cross flag, about 25 miles west of Texel, apparently making for Ymuiden'. Two days after (the 19th) these officers, together with Flight Lieutenant Bolton, made another long patrol into this area in an H. 12 machine (N. 8662), but this time the patrol was of more interest, for, when near the Texel, they were shelled by a German destroyer. 'Eighteen rounds were fired. Shooting was very bad, all shots falling short.'

The next day (the 20th) Flight Commander Leckie and Flight Lieutenant Fetherston, with Petty Officer Thompson and Air Mechanic Grant, left in the H. 12, N. 8666, on a special submarine patrol for the Smith's Knoll pillar buoy area. The weather was very bad—'the sea was choppy and the visibility very low and rain falling'. They were, however, to have the good fortune to sight two enemy submarines, for, in Leckie's words:

'At 1.03 p.m., when flying at a height of 450 feet in position 5 miles north of Smith's Knoll pillar buoy, and steering north, a submarine was sighted steering south, with her conning tower above water. Another submarine was seen steering southward about a mile astern of the first one. The second submarine had the top of her conning tower just awash. This submarine submerged immediately afterwards and only a slight wash could be seen.'

'1.05 p.m. Bombed first submarine with two 230-lb. bombs. One bomb dropped in the swirl made by the conning tower and directly astern of it. The second bomb dropped within 30 feet of the conning tower, slightly

360 GREAT YARMOUTH AIR STATION DURING 1918 UP TO  
abaft. . . . The first bomb either failed to explode or, crashing right through the submarine, exploded in the submarine or directly beneath it.

'The second bomb exploded and a column of water was seen thrown in the air and black deposit from T.N.T. was afterwards visible on the surface. When bombs were released the submarine was submerging at an angle of from  $15^{\circ}$  to  $20^{\circ}$  from the horizontal.

'Immediately after the dropping of the bombs the stern of the submarine was seen to rise out of the water, cant over and disappear at an angle of fully  $60^{\circ}$ .

'Seaplane was put about and circled around the spot where the submarine was sunk, and a large patch of thick oil, 50 feet in diameter, was observed on the surface.

'Owing to the low visibility and that the seaplane was almost uncontrollable on account of the extremely bumpy weather, the patch of oil was soon lost sight of.'

Thereafter, he reported the details of his attack to the air station, and then returned to it. It is now known that, although the submarine in question was badly damaged, she was not sunk.

Although so much prominence has been devoted to the work of flying-boats during this month, it must not be thought that there was any cessation in the work done by seaplanes and land machines, for this went on as usual, and grew more intense as each week passed. The following extracts made from notes written at the time give some idea of this side of the station's activities:

*'Sunday, February 17th.*

'Glorious day and flying at maximum. Flying-boats out all over North Sea, accompanied by Camels in some instances, as on Friday a Felixstowe boat was attacked by enemy and shot down in flames. . . .

*'Monday, February 18th.*

'Perfect flying day, and consequently great activity in the air. Camels are now doing hostile aircraft patrols in Ostende direction over sea to try to protect flying-boats and shipping, so we have a great deal to do. . . .

*'Tuesday, February 19th.*

'Another lovely spring day, and the air thick with machines starting out on their daily round and common task. Boats going out over other side. B.E.'s, Schneider, and Shorts patrolling shipping channels for submarines. Camels off to a point 50 miles away to patrol, out to sea, for German seaplanes from Ostende—they, the enemy, attacked and brought down in flames a flying-boat from Felixstowe in this area about three days ago. Two Camels go in company with a Schneider; the latter escorts us in case we fall into the sea, as the life of a Camel in the water is about 10 minutes, and sometimes ships are conspicuous by their absence.

'Thought we had lost an American Officer<sup>1</sup> who is training here. He failed to return from patrol, and was several hours overdue, when, just as it was getting dark, he turned up. He stopped his engine inadvertently, and having landed, could not get it going again for an hour or two.

*'Wednesday, February 20th.*

'Great excitement last night, as we had one of our usual "stunts" preparing for bombardment or invasion at dawn. . . .

'Unfortunately, one of our pilots failed to return this evening. He went out on a Schneider and has not come back. As it is blowing a gale this evening, I do not think Flight Sub-Lieutenant Budd stands much chance. . . .

*'Thursday, February 21st.*

'Blowing pretty hard from west this morning; all flying practically suspended. Pigeon arrived in at dawn from Budd, to the effect that he was shot down off Winterton. A Short seaplane,<sup>2</sup> a Schneider,<sup>3</sup> and a "Boat"<sup>4</sup> went off at dawn to look for him. The two former were an hour overdue at 10.30 and nothing has been heard of them. . . . The Captain told Cadbury to send out a Camel to look for the now three missing seaplanes. . . . He pushed off and searched the sea for about 10 or 15 miles out between Cromer and Winterton as, just before he left, a pigeon came in bearing a message to the effect that the Short had landed about 6 miles out and was sinking rapidly. . . .

'Luckily, just after Cadbury got in, two pigeon messages came in—one, to say that the Short outfit had been picked up by a trawler. The pilot and observer had been clinging to an upturned and slowly sinking float for 2 hours before being rescued. . . .

'. . . The second message stated that the Schneider pilot was safe aboard a drifter. His engine failed just as he was passing the drifter and he was forced to land. His machine turned over and sank soon after he landed, as the sea was so rough. But for the presence of the drifter he would have handed in his check.

'Budd, I am afraid, is given up as lost, but we are very thankful that three were not lost looking for him.'

If it had not been for the resource shown that day by one officer—Flight Sub-Lieutenant E. A. Mossop—the pilot and the observer of the Short seaplane (Flight Sub-Lieutenant Ellis and Air Mechanic Deeley) would have been drowned. Mossop, while searching for Budd, noticed the Short seaplane 'in a risky condition' on the water about 3 miles to the north of the Newarp

<sup>1</sup> There were at this period a few officers of the United States Navy attached for duty with the air station.

<sup>2</sup> Piloted by Flight Sub-Lieutenant S. J. C. Ellis and Air Mechanic Deeley.

<sup>3</sup> Piloted by Flight Sub-Lieutenant E. A. Mossop.

<sup>4</sup> The H. 12, N. 8666, piloted by Squadron Commander Stewart.

362 GREAT YARMOUTH AIR STATION DURING 1918 UP TO  
light vessel; he then flew to the south, near the Cross Sands light vessel, where he could see some trawlers. He alighted in the heavy sea that was running, taxied up to one of them—the *Saxon III*—hailed her master, and asked him to go to the aid of Ellis and Deeley, which he did. The sea was then too bad to allow of Mossop leaving the water, but he managed to come alongside another trawler, the *Girl Margaret*, to whose stern he made fast his machine. He then clambered aboard this vessel and sent a message by carrier pigeon to the air station, informing the commanding officer of his actions. The *Girl Margaret* then started for Yarmouth, towing Mossop's Schneider seaplane.

Meanwhile the master of the *Saxon III* had found Ellis and Deeley on their Short seaplane which, in the naïve words of the report, 'by now was upside down and in a somewhat risky condition'. Ellis and Deeley were rescued, but their machine sank a few moments afterwards.

A heavy gale was blowing now and Mossop's Schneider seaplane soon turned over and sank. When reporting on the action to save Budd (who was never seen again, although his machine was found), Wing Captain Samson stated that: 'I consider Flight Sub-Lieutenant Mossop's prompt action and the skilful manner in which he landed his seaplane in a heavy sea certainly saved the lives of Flight Sub-Lieutenant Ellis and Air Mechanic Deeley.'

On the last day of February the daily report of the air station read: 'Perfect flying day and every available machine up'. The one for the following day contained the laconic statement: 'A north-easterly gale sprang up during the night and is blowing hard. No flying as a consequence.' Reports such as these help to illustrate the difficulties of maintaining a constant aerial patrol over the North Sea.

On March 11 it was believed that the German Fleet was 'coming out', with the result that the Admiralty ordered all seaplanes and land machines to stand by at the air station, and two flying-boats were sent off, one to patrol the area around Terschelling and the other to the Dogger Bank, but neither of them sighted anything of the enemy's fleet.

On the 18th the flying-boats from the air station had their first engagement with enemy seaplanes. On that morning, just before 10.30 a.m., Flight Commanders Leckie and Livock left the Roads in F. 2a, N. 4512, with Flight Lieutenant Brenton as the gun-layer and Petty Officer Thorpe and Air Mechanic Chapman as the crew. At 11.45 a.m., 'when 10 miles bearing 45° from end of

'Terschelling', they 'sighted two hostile, two-seater planes 5 miles ahead'. They gave chase promptly and a 'running fight ensued until Rottum<sup>1</sup> was observed on starboard bow'. During this running fight they had 'fired all ammunition from two forward guns, numerous tracers were seen to enter the fuselage of one hostile machine, but evidently no vital part was struck as the enemy continued on his course....' Then their machine was hit 'in several places'. Half an hour after the chase first started they were compelled to give it up, 'as one petrol tank was punctured in the bottom and 50 gallons of petrol escaped into the bilge of the boat. Port oil tank was also punctured and some oil lost.'

They now headed westward, along the Frisian coast, and, at 12.45 p.m.,

'when 5 miles off Terschelling three hostile scout seaplanes were observed 5 miles on the starboard bow. Course was immediately directed to the south-west to avoid the enemy, as both forward guns were jammed and very little ammunition left. The enemy altered course to intercept us and took up position on starboard quarter. One of the three machines got within range and opened up very accurate fire, again puncturing the petrol tank. A second machine attacked on starboard beam at close range, to which we replied with half a tray from one of our rear guns. This machine was then seen to drop out of the fight.'

'By this time *Large America* was flying within 5 feet of the sea and the nearest enemy machine in station directly behind us.'

'The enemy continued to fire bursts at frequent intervals from a range of 200 yards, making good shooting, several shots taking effect in the tail.'

At 1.10 p.m., and 'when in position 10 miles west of south-east end of Texel, the enemy abandoned the pursuit'; the flying-boat was then turned homewards.

Their adventures were not yet over, for at 2.45 p.m. they 'sighted a submarine (nationality unknown) 10 miles south-south-east of Smith's Knoll pillar buoy. As the bombs had been previously dropped in the fight the submarine was not closed, but reported to base on arrival, W/T aerial having been carried away.'

At 3.10 p.m. they alighted in Great Yarmouth Roads, having been in the air for just over 4 hours. Both these officers reported of the enemy machines that:

'with reference to the types of machines engaged, the first two seen were single-engine two-seater machines, one machine appeared to be faster than

<sup>1</sup> Rottum is an island immediately opposite Borkum at the mouth of the western Ems.

'These machines appear to be easily handled and are quite formidable.

'The shooting from the first machine was excellent. It was observed that tracer and explosive ammunition was freely used. The damage to *Large America* confirms this fact, also several rounds could be seen exploding in the air. . . .

'With reference to the three scout machines, these appeared to be about the same size as our Sopwith Baby seaplanes and slightly faster than the boat.

'In this case, also, one machine was left by his companions to do the bulk of the fighting. The method of attack of this machine was to get directly behind the boat on the same level. This is practically the only blind spot in the boat, and, unless by yawing the machine about, we were unable to bring our guns to bear upon him.'

They also added that 'we arrived at our base with only sufficient petrol for another half-hour's flying, thus confirming the wisdom of breaking off the fight when we did'. The reason why there was so little petrol left was because almost 50 gallons had escaped from the punctured petrol tank into the hull of the boat.

Some interesting details of this action are recorded by an officer at the station, namely, that:

'there was no manœuvring or anything like that—the two machines just flew along side by side pumping lead into each other as hard as they could. . . . Suddenly the enemy got the range, and bullets whistled in all directions. One skinned Leckie's eyebrow and exploded in the instrument board with a terrific crash, shattering the instruments; another whipped through Livock's coat, while a third punctured his boot. The hull was simply riddled with bullets; flying wires, oil tanks, petrol tanks being shattered. Meanwhile, three or four guns from the "Boat" had been drilling the German through and through, yet nothing happened. Eventually, the "Boat" had to break off the engagement through lack of ammunition, and turn homewards. Through the mist three German scouts hove into view—one turned tail and fled, the other two closed to attack.

'For an hour and a half these two scouts dived and sprinkled with bullets the now defenceless "Boat", yet, although the hull was hit and holed everywhere, and although 5 men were sitting and moving about inside, not one was hit, nor a single vital part touched—like the sword and basket trick. The "Boat" got back here safely and looks a horrid sight.'

Shortly after this action the practice of sending flying-boats singly over to the German coast was discontinued, and they were sent over at least in pairs.

An officer of the German Naval Air Service has been good

enough to contribute the following note on the activities of their machines during this day:

'On March 18 a squadron of 5 Brandenburg chaser machines made a reconnaissance flight into the Great Yarmouth waters. After a flight of an hour and a half the Newarp light vessel, with its distinguishing mark of three balls, was sighted. A course was then laid for the Smith's Knoll light vessel, but it was found that it was no longer in its usual place, and there was only a round buoy with a trellis superstructure. At the southerly point of Winterton Ridge several English fishing-boats, escorted by patrol boats, were passed. These opened fire, but were so long in doing so that our machines were by then out of range. Owing to the foggy weather, the approach to the light ship on Cross Sands was made without incident or conflict. One seaplane was obliged to alight, owing to the breakage of a cooling water-pipe, but her pilot was able to repair the damage, and all machines returned uninjured, although the area patrolled by Curtiss boats was crossed several times.'

From this it will be seen that the enemy had penetrated in force right into the heart of the area patrolled by machines from the air station, but, largely due to mist, neither side came into contact with each other. That the enemy were fortunate in this respect may be gathered from the following extract from some notes made on that day dealing with the activities of the air station:

'Another magnificent day and great flying activity as a consequence. . . . As a commencement of the day's operations, 6 Camels went from here to patrol an area about 50 miles away in search of hostile seaplanes which often frequent the spot, leaving here in the early morning.'

On the next day (the 19th) the enemy penetrated into the area around the Cross Sands light vessel and again eluded our patrols, for an officer of the air station, writing at the time, said:

'Another day of great activity. I had just got four Camels off to Shipwash when a signal came through that there were five German seaplanes 27 miles out to sea from here. Immediately great excitement. Nicholl pushed off in his D.H. 4; I flew off in my Camel, followed soon after by numerous other D.H. 4's and Camels. We passed over Cross Sands lightship, and went out to Smith's Knoll and cruised about there for about 20 minutes. . . . However, we returned an hour later and found that the German seaplanes had come in towards the coast and had struck Cross Sands lightship at 9.20 a.m., and then gone south. So we missed them by 5 minutes. We were all frightfully sick, as with the number of machines we had out there, we had a fair chance of bagging the lot.'

On the following day (the 20th) the same officer was able to record that:

'Determined not to let an enemy machine pass through our area again unscathed. The Wing Captain has kept a constant stream of patrols to and about likely spots with Camels—a great strain on machines and pilots.'

At this period the float seaplanes and land machines from the station used to patrol from Smith's Knoll to the Shipwash light vessel. The patrols made by the flying-boats were not routine patrols, but were performed each day in accordance with instructions from the Admiralty, and the areas which they covered were the Frisian coast, the western approaches of Helgoland Bight, and the Dogger Bank. The patrols from Felixstowe air station were arranged also so that they interlocked with those from Great Yarmouth (except that no land machine patrols were made from the former air station), with the result that the southern half of the North Sea was patrolled hourly by aircraft during daylight. Those in authority at Felixstowe instituted a special patrol for hunting submarines, known as 'The Spider Web'. The historian<sup>1</sup> of that air station has described this patrol as follows:

'This tremendous spider web was sixty miles in diameter. It allowed for the searching of four thousand square miles of sea, and was right across the path of the submarine. A submarine ten miles outside of it was in danger of being spotted, so at cruising speed it took ten hours for a U-boat to cross it. Under ordinary conditions a boat could search two sectors—that is, a quarter of the whole web—in five hours or less. The tables were turned on Fritz the hunter; for here he was the hunted, the quarry, the fly that had to pass through some part of the web. The flying-boat was the spider.'

'The Spider Web Patrol was based on the North Hinder light vessel, which was used as a centre point, and allowed for a thorough searching of the sea in a forty-mile radius. It was an octagonal figure with eight radial arms thirty-eight sea-miles in length, and with three sets of circumferential lines joining the arms ten, twenty, and thirty miles out from the centre. Eight sectors were thus provided for patrol, and all kinds of combinations could be worked out. As the circumferential lines were ten miles apart, each section of a sector was searched twice on any patrol when there was good visibility.'

'A chart was kept showing the positions, dates, and times of day that submarines were fixed by wireless, and it was from this chart that the sectors which would pay for searching were determined.'

'The pilots were to boom out from Felixstowe to the North Hinder, a

<sup>1</sup> Squadron Commander T. D. Hallam, D.S.C., who adopted in his writings the pseudonym of 'Pix'.

distance of fifty-two sea-miles, fly out a radial arm as instructed, and then proceed along the patrol lines in the sectors to be searched, sweeping from the outside to the centre, returning to the North Hinder and so to the base.'<sup>1</sup>

For the rest of March patrols were steadily made from Great Yarmouth air station, especially anti-submarine ones. During the month four submarines were sighted, two of which were attacked. These attacks took place on the same day—the 21st; the first of them was made by Wing Captain Samson, flying in a D.H. 4 with Air Mechanic Radcliffe as his observer. This officer sighted the periscope of a submarine about 6 miles to the south-east of Lowestoft, but before he could arrive over her she had submerged. Nevertheless, two 65-lb. bombs were dropped near where she was last seen, but with no visible result.

An hour later Flight Lieutenant W. L. Graham, while flying in a B.E. 2c, sighted a periscope near the same spot and released his bombs, but with no success. It should be said that the appearance of oil on the surface of the sea after such attacks was not *ipso facto* accepted as a proof of the loss of the submarine, because the enemy were known to release quantities of oil with the object of deceiving their pursuers. About this time the enemy resorted also to another device, which consisted of a kind of torpedo with a quantity of oil in its head instead of an explosive charge. This apparatus was fired from the torpedo-tubes and proceeded at about the same speed as the submarine, leaving traces of oil in its wake. By its use the enemy submarine commander hoped to mislead his pursuers into bombing this trail, while the submarine went off on another course.

During this month (March) the total mileage patrolled by machines from the air station was 32,906 (as compared with 19,390 in February), the highest for one day (the 21st) being 3,584.

Although the activities of the flying-boats have figured somewhat prominently during the opening months of this year, the work done by the pilots of other machines must not be forgotten, especially those of the Short seaplanes which, as one officer said, 'had to do all the routine dirty work'.

Some idea of this 'dirty work' may be gathered from the following account written by 'a culprit':

'When I first came to Yarmouth as a pilot on the Short flight, either by sheer luck or design of the powers that were, I was fortunate in carrying

<sup>1</sup> *The Spider Web*, pp. 33-4.

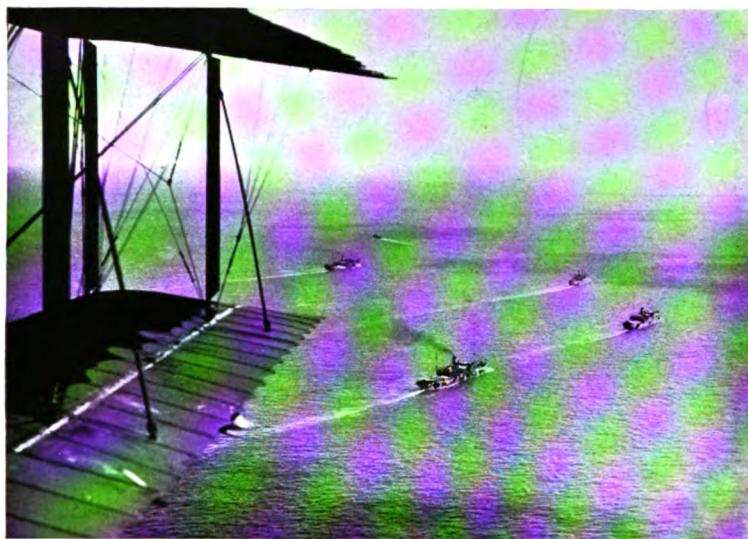
out my first few patrols under ideal weather conditions. It seemed to me that there could be no more enjoyable way of helping the war along than carrying about a 230-lb. bomb with the prospect of being able to drop it on some unfortunate enemy submarine, which, even supposing I should chance to miss it, could not possibly retaliate in any way. Later on, however, I found the snag. Owing to the height of the airscrew above the water, and to the comparative lightness of the machine, it was possible for the Shorts to take off on a sea that would have been fatal to any other type of seaplane, and I have recollections of some very unpleasant patrols as a result of what I considered to be this failing on their part. Until the middle of 1918 this was the only objection to an otherwise very pleasant occupation.

'About this time, however, the continual interference by the flying-boats with the enemy's patrols on the other side decided the latter to return the call in our area, which they did, and the prospect of meeting them while out in a Short, even when escorted by two Schneiders, was anything but attractive. The pilot of the Short, having no gun at all, had to console himself with the knowledge that his observer in the back seat had one, which was not fitted with any sights. Here again, either by sheer luck or design, I, personally, never met any hostile seaplanes. . . .

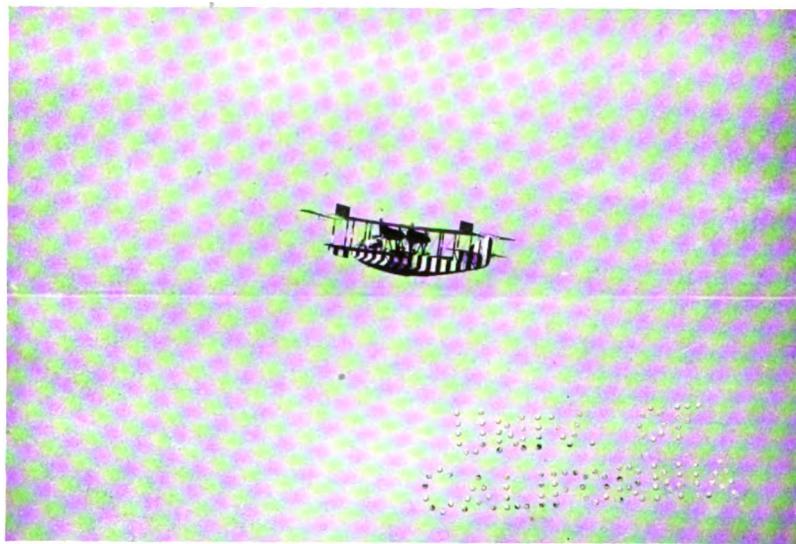
'Fog was the most unpleasant of all flying conditions and was very trying to the nerves. On one occasion I had been told off to take a Short out and look for a Schneider which had started on the Haisborough patrol and had not returned after a reasonable time. The visibility was not good at Yarmouth, and a bit further north the fog became so thick that I could only follow the coast-line by flying about 15 feet above the white surf on the beach. It occurred to me at the time that, if by any chance the Schneider was still in the air, and had been forced to do the same as myself, it would be decidedly unhealthy when we met.

'My mind was set at rest later on, however, by a fleeting glimpse of the Schneider drawn up on the beach with the pilot standing alongside. Having carried out my instructions, it only remained to turn home and report, because I was flying too low for the observer to be able to let out the aerial in order to send a wireless message.

'But I found that even now my troubles were not over. The cliffs along the beach to port left no choice but to make a right-hand turn, and as soon as I started to do this, the surf on the beach was swallowed up in the fog, and I could see nothing by which to form an idea through how many degrees I had turned. The compass, of course, has an objectionable habit of starting to swing when a turn is made, and requires a certain time on a straight course to steady itself again. My chief desire was to avoid sighting the cliffs dead ahead after making the turn. In my anxiety I misjudged the swing of the compass, and three times I picked up the line of surf after turning out, only to find the cliffs still on my left, and that I was still flying in the same direction. On the fourth attempt I was lucky, and the cliffs loomed up on my right-hand side. Needless to say, I was very glad to get back home and brush my hair down from the perpendicular.'



Convoy photographed from escorting Short seaplane.



F. 2 a flying-boat over the North Sea.

NO. 111111  
ANALOGUE

The work done by the Schneider seaplane pilots on the station must not be forgotten, although the machine was by now almost obsolete. One of their pilots, speaking of the Flight, has said since that it

'consisted of two or three old Schneiders, patched and warped and bone-rattling, which were used for any job going. . . . The machine was naturally a little difficult (sensitive and light) to take off and land, especially on the troubled seas which were commonly encountered at Yarmouth. There was the danger of smashed airscrews before getting up speed; the danger of turning turtle on gaining speed and alighting. One was always drenched



with spray. They were good machines in the air, but with bombs and other gear it was unwise to load them too much. They had no sights for bombing, but a Lewis machine-gun firing through the airscrew, and one also on the top plane. A carrier pigeon, fresh water, and sea anchor were carried as well.

'The duties of the Schneider flight were extraordinary in their variety.

*'Types of Patrols.'*

- '1. Hostile aircraft patrol. Yarmouth War Channel to Orfordness, to try to catch hostile torpedo-carrying seaplanes.
- '2. Hostile submarine and aircraft patrol to Smith's Knoll light vessel and War Channel area.
- '3. Hostile submarine and aircraft patrol to Haisborough light vessel via other light vessels—Newarp, for example.
- '4. Hostile submarine and aircraft patrol to Cross Sands area.
- '5. Hostile aircraft patrol to Shipwash area with two Camels.
- '6. Hostile aircraft patrol with two Camels and Short seaplane to Smith's Knoll.
- '7. Hostile aircraft patrol to Smith's Knoll and Shipwash with one flying-boat.

bb

‘8. “Decoy” patrol to Smith’s Knoll—Camels. (Three Schneiders left before the Camels and circled round the Knoll till the Camels came; after a while returned. The decoy did not work.)

*‘Special Patrols.*

- ‘1. Escorting the mine-layer (H.M.S. *Princess Margaret*).
- ‘2. To North Hinder light vessel with flying-boat and Camels.
- ‘3. German fleet “Scare” patrols.
- ‘4. Patrols to various points at which submarines and mines were reported.
- ‘5. Special emergency patrols, e. g. for missing machines.
- ‘6. Anti-Zeppelin patrols, one of which consisted of two flying-boats, three D.H. 4’s, three Camels, one Short, and two Schneiders!

‘It was the machine for the lover of solitude and independence and a wandering kind of life.

‘The Schneider was a sort of detective, exposing all mysteries, such as whales mistaken for submarines, streaks of oil, and rescuing colleagues in difficulties. Any wild rumour—out went the Schneider to investigate! They were the Police Force of the Yarmouth Patrol.

‘The question is often asked—how would the Schneider, in the hands of a seasoned Schneider pilot, have fared in a scrap with a German seaplane? The Schneider had no sensational accomplishments to its name at Yarmouth, probably because of the amazing way in which it escaped actual contact with the enemy. Perhaps the lonely forager was often seen—unknown to himself—but left alone because of sympathy or fear! Schneider patrols usually lasted from one and a half to two hours. The height at which the patrols were made was comparatively low, for experience went to show that small objects, such as periscopes, could not be detected from an enclosed machine like the Schneider from greater altitudes, and detection from above of a low-flying Schneider was extremely difficult.’

At midnight on March 31 the Royal Naval Air Service lost its separate entity along with the Royal Flying Corps, for the two were merged into one single Service—the Royal Air Force.

On that day there were at Great Yarmouth air station 71 officers and 7 warrant officers, with 3 officers at the night landing-grounds, all under the command of Wing Captain C. R. Samson, D.S.O.

During the previous three months the following officers had joined the station (apart from those mentioned directly in the text): Squadron Observer T. Haggerston, Flight Lieutenants W. L. Graham and L. L. King (acting), Flight Sub-Lieutenants S. D. Culley, P. W. Cunliffe, T. C. Gordon, V. S. Green, H. S. Holman, G. A. T. Hudson, F. G. S. Musson, C. C. G. Nickols, F. A. Norton, O. W. Pellatt, and A. D. Pole, Observer Sub-Lieutenants F. R. Bicknell, W. B. Cass, R. Gray, A. D. MacMillan,

J. W. Nixon, H. G. Owen, W. P. Parkhouse, S. Plowman, and F. L. Wills. Four 'specialist' officers also had joined the station: Lieutenant S. P. Martin, R.N.V.R., Sub-Lieutenant L. V. Beckett, Assistant-Paymaster S. H. Withy, R.N.R., and Surgeon J. C. A. Allan, M.B., R.N. The station had 4 additional warrant officers as well: R. E. A. Allen, A. G. Chapman, W. R. Heywood (who was promoted recently from the rank of petty officer), and S. H. Miller.

The night landing-grounds were still under the command of Lieutenant Commander F. W. Hodges, R.N.V.R., with his headquarters at Lowestoft. Lieutenant A. Scarrisbrick, R.N.V.R., was officer-in-charge at Covehithe and Aldeburgh, and Lieutenant G. E. Luckstead at Bacton and Holt.

The standard of skill and the flying experience of the senior flying officers at the air station were of a high order, as may be gathered from the following entry of 'machines flown' made in the log-book of one of the flight commanders. The extract, which was typical of the more experienced officers, reads:

'Grahame-White biplane (Box-kite).  
 Bristol (Box-kite).  
 Maurice Farman biplane.  
 B.E. 2a biplane.  
 B.E. 8 biplane.  
 Short Pusher seaplane (Gnome).  
 Short Tractor seaplane (Gnome).  
 Short Tractor seaplane (Canton Unné).  
 Short Tractor seaplane (225 Sunbeam).  
 Short Tractor seaplane (240 Sunbeam).  
 Short Tractor seaplane (220 Renault-Mercedes).  
 Schneider Cup Sopwith warp control (100 Mono.).  
 Schneider Cup Sopwith aileron (100 Mono.).  
 Baby Sopwith (110 Clerget).  
 Baby Sopwith (130 Clerget).  
 Hamble Baby (130 Clerget).  
 Small America Boat ((2) 100 Clergets).  
 Short seaplane (150 Sunbeam).  
 B.E. 2c (70 Renault).  
 F. 2a ((2) 360 Rolls Royce).  
 Short Tractor seaplane (310 Sunbeam).  
 Short seaplane (260 Sunbeam).  
 H. 12 America Boat ((2) 360 Rolls Royce).  
 Sopwith Camel (130 Clerget).  
 Hamble Baby "Convert" (130 Clerget).  
 Sopwith Camel (180 B.R. and 130 Clerget).

Sopwith Pup (110 Le Rhône).  
Fairey 3B. (260 Sunbeam).  
Sage (2-seater) (200 Hispano-Suiza).  
Raf Boat (260 Sunbeam).  
Camel Short (260 Sunbeam).  
D.H. 9 (200 B.C.R.).  
Avro (100 Mono.).'

Many of the officers on the station were Canadians, for in the early days of the War a large number of Canadians came over to this country to join the Royal Naval Air Service and the Royal Flying Corps, and as many as 800 officers and cadets had been enrolled in the latter corps up to the time when a training centre for flying cadets was organized in Canada itself. Altogether, over 8,000 Canadians served as officers in the King's flying Services, and at the date of the Armistice there were nearly 2,500 in the Royal Air Force, while 1,200 Canadian cadets were undergoing training in England and Canada. In fact, the 'air effort' of this Dominion was greater than any other of the King's dominions.

## THE ROYAL AIR FORCE

AS stated already, 'The Air Force (Constitution) Bill, 1917', received the Royal Assent on November 29, 1917, and on December 21 an Order in Council provided 'for the Membership of, and the Exercise of Powers and Duties and the Transaction of Business by, the Air Council'.<sup>1</sup> A further Order in Council of January 2, 1918, announced that the Air Council was to be established on the following day.

The first of these Councils consisted of the following members: Secretary of State and President of the Council (Viscount Rothermere), Chief of the Air Staff (Major-General Sir H. Trenchard, K.C.B., D.S.O.), Deputy Chief of the Air Staff (Rear-Admiral Mark Kerr, C.B., R.N.), Master-General of Personnel (Commodore Sir Godfrey Paine, C.B., M.V.O., R.N.), Comptroller-General of Equipment (Major-General W. S. Brancker), Director-General of Aircraft Production in the Ministry of Munitions (Sir William Weir), Administrator of Works and Buildings (Sir John Hunter, K.B.E.), Parliamentary Under-Secretary of State (Major J. L. Baird, C.M.G., D.S.O., M.P.), Additional Member of Council and Vice-President (Sir David Henderson, K.C.B., D.S.O.), Secretary to the Council (Mr. W. A. Robinson, C.B.), and Assistant Secretary (Mr. H. W. McAnally).

For the next three months the Council was engaged in two difficult tasks: firstly, of bringing together and building up the administrative, professional, and technical staff to perform the departmental duties which the Council had been appointed to control; and, secondly, of amalgamating the two flying Services into a single Air Force. Its work was hampered somewhat by internal troubles. It had been understood generally that Viscount Cowdray would be the first Air Minister, but, owing to an unfortunate difference of opinion with the Prime Minister (Mr. Lloyd George) as to the correct method of conducting official business, he resigned. His place was taken by Viscount Rothermere—his brother having refused it publicly a few days before. On Sunday, April 14, an announcement was made that Major-General Sir Hugh Trenchard had resigned the post of Chief of the Air Staff,

<sup>1</sup> Vide *The Beginnings of Organized Air Power*, pp. 174-8.

and that Major-General F. M. Sykes, C.M.G., had been appointed in his stead. On April 15, in answer to a question in the House of Commons by Mr. W. Joynson Hicks, Major J. L. Baird announced that General Trenchard's resignation resulted from the fact that he took a view of the powers and the duties of the Chief of the Air Staff which the Secretary of State for the Royal Air Force<sup>1</sup> could not accept.

The situation was made more acute by the prompt resignation of Sir Godfrey Paine and Sir David Henderson from the Air Council, as a protest against the treatment of Sir Hugh Trenchard. The result of it all was that on April 25 Viscount Rothermere resigned the office of Secretary of State for the Royal Air Force, and immediately afterwards Sir William Weir was appointed in his stead. Sir Hugh Trenchard returned shortly afterwards to France to organize and command the Independent Air Force.

The creation of a department so large within a period of two months from the time the 'Air Force (Constitution) Bill' became law was a remarkable achievement, for, by the end of March (1918):

'a set of passable orders, instructions, and regulations had been drafted, the fitting of the personnel of the two separate services into the single new force begun, the commissioning of new entrants, training, recruiting, posting, medical treatment, and other incidentals of administration provided for, arrangements made for the whole complicated system of supply, maintenance, and payment of the new service. District commands had been instituted and a hierarchy of commands and administration created. The machinery had been built and was ready to begin to operate.'<sup>2</sup>

On March 7 a Royal Proclamation had announced His Majesty the King's Will and Pleasure that the Air Force should be styled the 'Royal Air Force'. In June His Majesty was pleased to direct that the Royal Air Force should take precedence after the Navy and the Army.

With the coming of the new Service the Royal Naval Air Service ranks disappeared: ordinary Ratings became Privates; Leading Hands, Corporals; Petty Officers, Sergeants; Flight

<sup>1</sup> A year later the enlargement of the scope of the Air Ministry necessitated an alternative in the designation of the Secretary of State, and on March 29, 1919, it was announced through the medium of a Press *communiqué* that His Majesty the King had approved of the title of 'Secretary of State for Air' being adopted in place of 'Secretary of State for the Royal Air Force'.

<sup>2</sup> Vide *The Beginnings of Organized Air Power*, p. 195.



Sub-Lieutenants, Lieutenants; Flight Lieutenants, Captains; Squadron Commanders, Majors; Wing Commanders, Lieutenant-Colonels; and so on, although it was some little time before the new titles came into general use.

The naval uniform of the Royal Naval Air Service—the distinctive tunic and forage cap of the Royal Flying Corps—disappeared officially, and their place was taken by a khaki uniform, in the case of officers similar in pattern to the uniform worn at the present day, except that, in addition to the lace rank-marks on the sleeves, second lieutenants and lieutenants wore small brass bars on each side of the cap badge, one on each side for the former and two on each side for the latter. These were abandoned at an early date.

Majors, and all officers of higher rank, had a circlet of gold oak-leaves on the peak of their caps; they were, in the parlance of the Service, 'brass hats'. A khaki shirt, brown shoes or boots, and a black tie were worn. The men were put into Army uniforms with Royal Air Force buttons.

Shortly afterwards this uniform for commissioned officers was replaced by a light blue uniform, which was superseded some time later by the present uniform. Officers were permitted still to wear their old naval and military uniforms until they were worn out.

The new Service followed the Army model in its arrangements for discipline and internal economy, which were provided for by applying to it a modified form of the King's Regulations for the Army. The Royal Warrant for the pay of the Army was applied also by a King's Order issued in March. The various Army regulations for Allowances, Supply, Transport, Barrack Services, Clothing, Ordnance Services, and Equipment were made applicable after suitable alterations. Units of the Royal Air Force drew their rations from the Royal Army Service Corps, except in the case of those serving with the Royal Navy or those which could obtain them more conveniently from naval stores.

There were many reasons why the Royal Air Force followed more closely the Army method of administration rather than that of the Navy. The chief one was that the Board of Admiralty is really the Lord High Admiral in Commission, and it exercises powers which, in the case of the Army, are exercised only by the Crown, so that the Admiralty method could not be used, as it would have meant the establishment of a kind of 'Lord High Aerial'.<sup>1</sup> The other reasons for adopting the Army model were

<sup>1</sup> *Vide The Beginnings of Organized Air Power*, p. 163.

that in the new Service the military personnel predominated, and, moreover, it was one which was more likely to be occupied with land rather than with naval operations.

Looking backward and considering the feelings at the time, it may be said that the change was regretted by many in both Services. It is natural that officers and men, considering only their associations together, their trials and triumphs, should become attached to their own particular organization. This is human, and when men hold themselves in readiness to give all they have—to give life itself—it is quite natural that they should feel that their sentiments should be considered. The larger aspect, at the moment, does not appeal; each section was patriotic within itself, ready at all times to bring this patriotism as their share to the large duty that confronted the nation. Things which to outsiders appear of no moment—a change in uniform, in the terminology of rank, in custom—are just things not understandable by men not 'under orders'. To risk limb or life—that comes in a day's work and is often its end. To change a system, to alter a usage, to end an order under which their brothers had so recently lived, fought, and died—that was another matter. Yet, while sentiment governed feelings, duty governed actions, and it must be said that, when it is considered that the change took place while a war was in progress—and during one of its most critical phases—it was creditable to all concerned that so little dislocation was caused.

THE EVENTS AT GREAT YARMOUTH AIR STATION  
FROM THE FORMATION OF THE ROYAL AIR FORCE  
UNTIL THE ARMISTICE

AT Great Yarmouth air station many changes took place with the formation of the new Force. The station's flights became squadrons: the 'Land Flight', composed of land machines, became known as No. 212 Squadron,<sup>1</sup> with Captain E. Cadbury, D.S.C., in command; the 'Boat Flight', No. 228 Squadron, with Captain R. Leckie, D.S.C., in command; and the 'Short and Schneider' Flights, No. 229 Squadron, with Major Stewart in command. The air station became a Wing—the 73rd—of No. 4 (Operations) Group. The other stations in the Group were Felixstowe, Burgh Castle, Covehithe, Aldeburgh, Westgate, and the Kite Balloon Section at Lowestoft. Lieutenant-Colonel Samson, D.S.O., relinquished his command of Great Yarmouth air station in order to command the Group, and his place as commanding officer of Great Yarmouth air station was taken by his former first lieutenant, Major (acting Lieutenant-Colonel) Vincent Nicholl, D.S.O., D.S.C. Lieutenant-Colonel Samson remained at the air station for some weeks until his head-quarters were removed to Felixstowe. The air stations in the Wing still remained under the Admiralty for 'operations' (but not discipline), and received their Lordships' instructions, as of old, through the commodore at Lowestoft, Commodore A. A. Ellison, C.B.

Despite all these changes the flying operations conducted from the air station were not affected, and on the 2nd (April) three F. 2a flying-boats made an 'extended patrol to Ameland and Borkum Riff' in formation. They left just after 7.30 a.m. and alighted at 12.40 p.m. During this patrol they sighted a Zeppelin airship '25 miles distant over Ameland but were unable to attack'. Every day for the next week flying-boats penetrated into this area—right into the enemy's waters—but, generally speaking, on their return their pilots 'had nothing to report'. A German

<sup>1</sup> At the formation of the Royal Air Force the squadrons of the Royal Flying Corps retained their old numbers, while those of the Royal Naval Air Service were numbered from 201 upwards. The number 60 was added to all wing numbers. Coastal units like Great Yarmouth and Felixstowe had not been formed into squadrons hitherto.

'Report of the North Sea Flight Commander for the period April 13–April 24—Enemy Curtiss flying-boats were sighted and attacked five times. The flying-boats, for the first time since they were first sighted, pursued the offensive against our aircraft in the Helgoland Bight. Our own machines hit them several times, but could not bring any down. The experience gained at Zeebrugge, that such machines could only be brought down after a long fight in the air, and by employing large quantities of ammunition, was confirmed. One of our machines was shot down in flames.'

On the 12th the enemy made the third airship raid of the year with 5 Zeppelin airships, which were led by Fregattenkapitän Strasser.<sup>1</sup> The airships came over Lincolnshire, Northampton, Lancashire, Warwickshire, and Norfolk. One of them, which crossed the coast at Spurn Head, reached Wigan, and another, which crossed near Cromer, reached Birmingham. Another raided Lincoln but did little damage, while two remained in the neighbourhood of the Wash and the Humber, where their bombs did also but little damage. Altogether 135 bombs were dropped (of a total weight of nearly 10 tons). Unfortunately, 7 people were killed and 20 injured. The material damage inflicted was slight, except in the Wigan district, where several cottages were wrecked or damaged.

Although several machines arose to the attack they were, largely owing to the fog and mist, unsuccessful in their attempts to destroy the raiders.

The part played by the air station in these attacks was described at the time by Major Cadbury as follows:

'I was just about to sit down to dinner yesterday when I got an urgent signal to repair immediately to the air station. I found that Zeppelins were about. The Germans *really are absolute experts* in foretelling the weather. We watched the tracks of Zeppelins crossing the coast-line at various points, and their subsequent attacks on Lincoln, Wigan, and other places. We had several machines up during the night, but the weather was so thick that they could achieve nothing.'

'I went off in my D.H. 9 about three-quarters of an hour before it began to get light. I have never flown a machine of this type at night before, let alone on a filthy night like last night, and have no wish to do so again. I went through 4,000 feet of clouds, to emerge into a clear stratum between two cloud levels, went through the next lot to 8,000 feet, but found more

<sup>1</sup> The two previous raids were made over Hull and Hartlepool, March 12 & 13.

clouds—enough to hide thousands of Zeppelins. Not having seen anything of the ground for about 40 minutes, I was fairly lost, but luckily, just as it was getting light, I came down to within 200 or 300 feet of the ground behind Cromer.

'One of the "boats" sighted a Zeppelin, but lost it in the clouds. Several other machines went up at dawn, but the thick weather proved too much for them. One fellow had a very narrow escape. He got lost in the inky blackness of the night and the fog, and came down to 200 feet to try and discover his whereabouts. His engine suddenly gave out and he just let his machine land itself. Missing a huge tree by inches, he merely wiped the undercarriage off his machine.'

'A Special Constable came along and Packe—the pilot—being alone, put him in charge of the machine while he went to telephone to Headquarters. When he left the machine it was just resting on the fuselage and lower planes, being very little damaged. When he came back he found a heap of charred ruins and a perfectly unperturbed Special Constable smoking a cigarette alongside. In leaning up against the machine, or examining it, he must have touched a small switch which ignites two Holt Flares. He said he heard a slight pop and a fizz under one wing, and then sat down and watched it burn.'

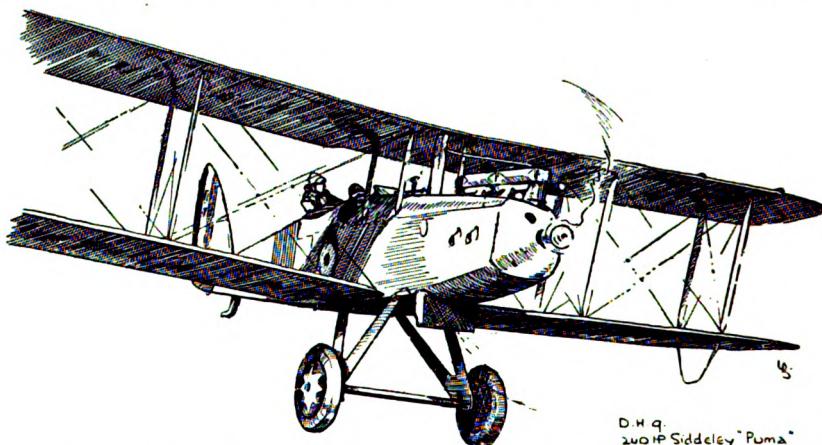
Cadbury's remark that 'one of the "boats" sighted a Zeppelin' refers to an attempt by Captains Leckie and Livock, in an F. 2a flying-boat—N. 4283—to bring one of them to action. Just before 5.30 a.m. on the morning of the 13th they left the Roads to 'search for a Zeppelin north-north-east distant 60 miles from Yarmouth'. A few minutes before 7.0 a.m. she was sighted at a height of 6,000 feet and about 10 miles away on the starboard bow, 'but, on observing the F. 2a, she descended into a dense fog bank and further efforts to locate her were unsuccessful'. Once more an enemy airship commander had evaded action in, to him, unpropitious circumstances by skilful use of cloud-banks.

The D.H. 9 referred to in Cadbury's account was, like its predecessor the D.H. 4 (which it resembled largely in appearance), built to the design of Captain Geoffrey de Havilland. Instead of the Rolls Royce engine it was equipped with the 230 b.h.p. B.H.P. engine, and with this could attain a speed of about 125 miles an hour at ground level.

The successor to this machine was the D.H. 9a which was equipped with the 'Liberty' engine, but machines of this type were not issued to Great Yarmouth air station until the summer of this year. With respect to certain of the De Havilland aircraft, it is important to note that in the D.H. 4 the main petrol tank

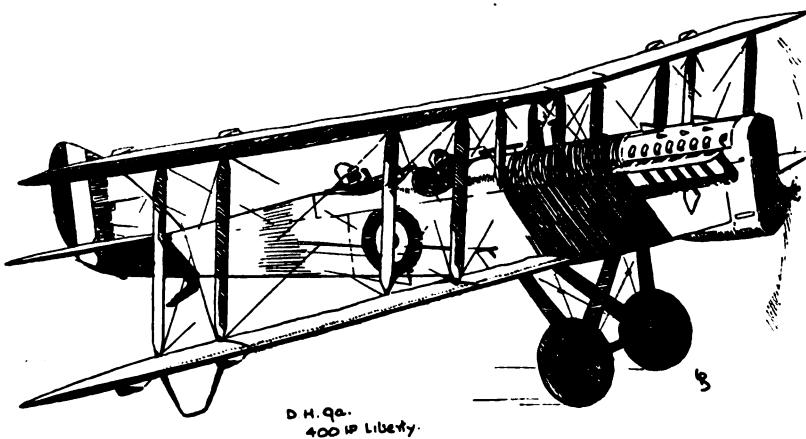
was between the pilot and the observer, but in the D.H. 9 and the D.H. 9a this tank was moved forward to a position immediately behind the engine and under the centre section. This alteration enabled the cockpits of the pilot and observer to be brought closer together, thus effecting better communication between their two occupants.

During most of April the weather was too bad to allow of much patrolling over the sea in land machines, but flying-boats were able to perform their allotted duties without much interruption. On the 20th a patrol was made by two F. 2a flying-boats into the



enemy's waters. The machines were F. 2a, N. 4289, Captains Leckie and Livock, Privates West, Chapman, and Money, and F. 2a, N. 8662, Major Stewart, Captain Cross, Privates Jupp, Grant, and Deeley. These two machines left the Roads at 8.55 a.m., and one hour and 40 minutes later 'made Terschelling light vessel'. Ten minutes later those aboard them sighted 4 enemy destroyers steaming at about 5 knots to the north-west of the light vessel. Three minutes afterwards 'four enemy mine-sweepers, camouflaged black and white', were sighted, steaming at an estimated speed of 15 to 20 knots. Still carrying on with the patrol the occupants of the flying-boats sighted, just before 11.0 a.m., 'two German battle cruisers, probably *Derfflinger* and *Mölike*, 53° 40' N. Long. 5° 5' E. in company with two four funnelled German cruisers, probably *Stralsund* class, and two small three-funnelled German cruisers, probably *Pillau* and *Gradenz*, and eight German destroyers, steering in line ahead, course east, destroyers zig-zagging at 20-25 knots'.

The machines flew around these ships for 20 minutes and then, at 11.15 a.m., F. 2a, *N.8662* (Major Stewart) put about, accompanied by her consort, who flew with her until Captain Leckie saw again the 4 destroyers previously sighted. As soon as these were seen Leckie left Stewart to examine these destroyers more closely. He 'approached to within half a mile at 4,500 feet and took some photographs'. The enemy opened fire promptly, and although they fired about 30 rounds of high explosive and shrapnel they failed to hit or damage *N.4289*. Both flying-boats then returned to the air station and alighted safely, after having



been in the air for 5 hours. The information as to the movements of the enemy's ships gained on this patrol was of considerable value to the Admiralty, who warmly complimented Captain Leckie and the crews of the two machines. A touch of humour was added to this patrol, because, when Leckie and Livock were circling over the German destroyers, Livock amused himself by signalling to them with an Aldis lamp. The remarks were humorous, although, perhaps, a little personal, and both these officers judged that there must have been some one aboard the destroyers with an intimate knowledge of certain aspects of the English language. They held this opinion because what appeared to be an acknowledgement was received by searchlight from the Leader.

Four days after this patrol was made the High Sea Fleet left the Jade in an attempt to raid the convoy traffic between England and Norway, for, as Admiral Scheer has remarked subsequently, 'a successful attack on such a convoy would not only result in the

sinking of much tonnage, but would be a great military success, and would bring welcome relief to the U-boats operating in the Channel and round England, for it would force the English to send more warships to the northern waters'.<sup>1</sup> Wednesday, April 24, was chosen for the attack. The fleet left the Jade at night-time in a heavy fog; by morning it had cleared up, but at 8.0 a.m. the *Möltke* was damaged severely, for an inboard propeller burst inflicting such serious damage that she could barely steam. Added to this disaster 'information received from the Naval Staff at 2.0 p.m. concerning the times of arrival and departure of convoys, indicated that we had not been lucky in our choice of a day to attack them. Apparently the convoys from England to Norway had crossed the North Sea on the 23rd. At 6.30 p.m. we received a wireless message from a U-boat that 11 enemy cruisers were about 80 miles behind us.'<sup>2</sup> So Admiral Scheer decided to abandon the operations, and the enemy fleet returned to its base without the Grand Fleet being able to catch it.<sup>3</sup> This was the last time that the High Sea Fleet ever left its base to conduct warlike operations in the North Sea.

The great value of Leckie's patrol was that it confirmed the knowledge of the Admiralty that the above attack was impending.

During the midnight hours of the 22nd and 23rd (April—St. George's Day) the now famous blocking operations at the mouth of the Bruges Canal at Zeebrugge and Ostende Harbour were executed under the command of Vice-Admiral Sir Roger J. B. Keyes, K.C.B., K.C.V.O., D.S.O. For some days before and after this assault flying-boats from Great Yarmouth air station made long patrols into the enemy's waters to try to detect any movements of the enemy's fleet. Some of this work was frustrated by fog. For instance, on the 24th, as one officer stated:

'I was up all night arranging for long patrols in boats, commencing at dawn. Dawn broke beautifully clear, but just as we were getting the boats launched, a thick fog blew up. At noon it cleared a little, and two boats went off. They were supposed to go within 50 miles of the coast of Denmark. After hours of suspense we were all overjoyed to see them arrive back after 7 hours and 50 minutes' flight. I take my hat off to the pilots—250 miles straight away from your base through fog is some effort.'

<sup>1</sup> *Germany's High Sea Fleet in the World War*, pp. 318-23.

<sup>2</sup> *Ibid.*, p. 322.

<sup>3</sup> On her way back to port the *Möltke* was struck amidships by a torpedo fired from *E. 42*—the resulting damage was not sufficient to sink her. One effect of this raid was to cause the route of the Scandinavian convoy to be moved farther north. Vide also *Battleships in Action*, vol. ii, pp. 214-15.



OBERLEUTNANT CHRISTIANSEN.

66  
62  
60

During the attack on Zeebrugge Mole little damage was inflicted on the seaplane sheds and most of the machines were on the mainland. It should be explained that the enemy had converted the railway sheds on the Mole into a seaplane station and kept their machines (when not in use) on railway trucks under the sheds, the roofs of which had been rendered bomb-proof by a thick layer of reinforced concrete. When the machines were wanted they were lifted off the trucks (which had been shunted into the open) by the cranes on the quay side and deposited on the water. As soon as the enemy received warning of an impending attack on the Mole, a locomotive (always standing by under steam) drew all those machines that were not required to resist the attack on to the main line and into safety.

There were, at this time (April), five hangars on the Mole, accommodating 55 to 60 machines. The commanding officer, as already stated, was Oberleutnant d. R. Christiansen, who had between 40 and 50 pilots under his command.

Owing to its proximity to Great Yarmouth and Felixstowe air stations combats between machines from Zeebrugge and these air stations were frequent during the spring and summer of 1918, and in these actions the enemy displayed considerable dash and ingenuity, being led most ably by Oberleutnant d. R. Christiansen. This officer was by profession a seaman, also a skilled aviator, an excellent shot, and a sportsman.

He was not long in taking his revenge for the attack on his station on the Mole, for on April 25 he, leading a flight of 7 Brandenburg monoplanes (5 single-seaters and 2 two-seaters), attacked two F. 2a machines from Felixstowe air station and, after a short fight, succeeded in shooting one down in flames—H. 12, N. 8677 (Captain Magor and Ensign Potter, U.S.N.). A German officer has been good enough to give a description of the attack on this machine, which is given below, because it offers an insight into the tactics employed by Oberleutnant Christiansen, with which officers and men from Great Yarmouth air station were to become familiar soon:

'Oberleutnant d. R. Christiansen shot down a Curtiss flying-boat in 133 a<sup>1</sup> after a long combat. After fire had been opened on the flying-boat from aft by the fixed machine-gun, and the machine-gunner in the stern of the flying-boat killed, Christiansen flew parallel with the boat, and his observer opened fire with his machine-gun at the oil tank at the rear of the port engine, setting the tank alight. The pilot of the flying-boat then tried to

<sup>1</sup> See map, facing p. 160.

alight, but as his machine was only 10 feet from the water, he could not turn her into the wind, so that she crashed on alighting and burst into flames. Of the crew, 3 men were seen swimming about, but the sea was too bad to allow of our machines alighting in the hope of saving them.'

As soon as the other flying-boat had reached Felixstowe air station and her pilot had reported the loss of his consort, it was decided to attempt to avenge this blow. So on the afternoon of the next day (the 26th) machines from this station and that of Great Yarmouth 'set off on a proper hurrah party for the North Hinder. Two D.H. 4's, Samson and Nicholl; one Camel, Cadbury; and three "Boats". Eight "Boats" went off from Felixstowe. Having swept the sea for 2 hours they returned, having sighted nothing.'

One of the flying-boats from Felixstowe (F. 2a, N. 8683, Captains C. MacLauren and R. F. L. Dickey, D.S.C.) flew over the Zeebrugge Mole at a height of 300 feet and came into a heavy barrage of 'flaming onions', but the machine was not hit. A similar patrol was made in force the next day, but the enemy was not sighted, and bad weather prevented it from being attempted again during the rest of the month.

A German officer has been good enough to give the following notes on the 'Activities of the North Sea Division' during April:

'Increased submarine hunting was necessary in the Helgoland Bight, owing to the appearance of enemy submarines. Three times we succeeded in dropping bombs on submarines which had dived, or were in the act of diving. Results, however, could not be ascertained. A wrecked submarine certainly was sighted on the Danish coast by our scouting machines. To conduct the submarine trade war, machines were ordered to sink all vessels found in the blockaded regions. Several sailing boats were stopped and sunk. The demand for men and materials was increased greatly by the escort service for outward-bound submarines and ships. The patrolling in the Helgoland Bight was done according to plan without any special occurrences. During the period April 23 to May 4, the North Sea Flight Division suffered the loss of 10 machines. The crews were saved, all but one pilot, whose observer was picked up, *after drifting for 73 hours at sea*, by a vessel from a mine-sweeping flotilla.'

The reference to the use of aircraft for the capture of merchantmen is of interest, for the enemy resorted in many cases to this method of warfare. The seaplanes employed on this duty used to fly in couples or three at a time, and when they sighted a vessel one of them dropped a bomb ahead of her (or fired a few rounds from a machine-gun into the sea) as a signal for her to heave-to.

As soon as she had obeyed this command, one of the seaplanes landed alongside her and put the observer aboard, who then ordered the master to proceed to a German port. The seaplanes then arose and flew round the vessel and escorted her into port. In the event of the master and crew endeavouring to overpower the observer, then the seaplanes would have swept the decks with machine-gun fire.

In closing the account of the main events of April, the following excerpt of a letter, written some time later by Captain Leckie dealing with the humorous side of one flying-boat patrol, is of interest:

'You may remember that Wing Commander Douglas Oliver was quite a character and used to refer to his pilots in a jocular way as "the brave boys". The expression, through oft-repeated use, became more or less a by-word, and one used to wait for it as Oliver, standing on the concrete and gazing at the sky, would say, "Beautiful morning! Let us send the brave boys on patrol." Or, to Vincent Nicholl, his "Number One"—"Where are the brave boys now, Nick?" And these expressions were in constant use at the air station long after Oliver left.

'Very early one morning,<sup>1</sup> "Jerry" Livock and I were ordered to patrol eastward as far as the mouth of the River Ems. The flying-boat F. 2a N. 4283 was run down the slipway before dawn and, with the first faint streaks of grey in the eastern sky, the patrol began.

'I have always wanted to meet the officer at the Admiralty who invariably ordered patrols to start at *dawn*. Upon most occasions any other time would have done just as well, but "dawn" was, apparently, a convenient term. Unfortunately, "dawn" breaks, during the summer, as early as 0230 hours, which meant that pilots had to be at the air station at 0130 hours at the latest.<sup>2</sup> How much or little sleep we got in those days can better be imagined.

'A few days before the patrol in question, "Jerry" Livock and I had been in action against some German seaplanes and our machine had been bumped about a bit, and indeed we were very fortunate to have escaped without having been brought down or having incurred casualties. On this occasion I felt sure we would be brought to action, as German activity in the Bight was considerable about then. The weather was extremely bad, rain fell incessantly, and blew in through a badly-fitting window in the cockpit of the boat. I remember that my neck and shoulders were thoroughly wet. Visibility was low and a constant and thorough look-out was required. I'm afraid our courage was particularly low that morning, and I'm sure that

<sup>1</sup> April 3, 1918.

<sup>2</sup> Apropos of this remark, one senior officer of the Royal Air Force once affirmed that 'the worst of this somewhat unpleasant war is that many estimable English gentlemen are required to take an active interest in affairs before the world has been properly aired and warmed'.

the last thing any one of the boat's crew wanted was a fight. Having patrolled to our eastern limit and seen absolutely nothing, course was set for home.

'At this time the enemy patrols from Zeebrugge were not coming very far north, and I used to reckon that once I was west of a line Terschelling-Dogger Bank, it was unlikely that any enemy seaplane would be encountered until close to Yarmouth, when one might meet the Zeebrugge patrols at the northern end of their beat.

'Imagine then, flying about 800 feet through rain and fog, sleepy, hungry, cold, wet, and thoroughly miserable, hoping against hope that the Terschelling line would be crossed without encountering the enemy. To break the monotony, "Jerry" opened a parcel of sandwiches wrapped in newspaper—sandwiches cut at the screech of dawn by a sleepy and disgruntled mess attendant, consisting of great slabs of war bread and fat, greasy roast beef—could anything be less appetizing?

'Handing a sandwich each to the engineer (the estimable Chapman), the W/T operator, the gun-layer, and to myself, "Jerry" munched his own sandwich—rather sadly—and mechanically smoothed the creases out of the wrapping paper on his knee. Suddenly the paper was thrust under my nose by the irrepressible "Jerry" and in the centre of the page I saw, blocked out in a black order, "A Prayer for Grace", the last two lines of which read . . . "and let us have peace for Christ's sake and bring the brave boys safely home"—a sentiment we most heartily echoed.'

About this period Lieutenant-Colonel Samson started to institute a number of 'offensive patrols' from the stations in the Group, which were referred to as 'coloured' patrols, namely, 'Red', 'Green', 'Yellow', and 'Black'. Their tracks embraced the southern half of the North Sea, and it was hoped by their use to make it impossible for the enemy seaplanes from Zeebrugge and Borkum to penetrate these waters without being brought to action. Unfortunately they did not achieve this end.

During May more patrols were flown from the air station than at any other time during its existence, for no less than 60,645 miles were covered, the highest amount for one day being 3,605 miles. The number of machines available was not large—about 4 flying-boats, 6 Short seaplanes, 6 Camels, and 4 D.H. 4's and D.H. 9's.

The same month saw considerable activity by German submarines off Great Yarmouth, and several attacks were made on these craft by officers from the air station, Major Cadbury bombing one on the 9th. Although one of his bombs exploded near her, it is known now that the submarine was not sunk.

This attack was followed by another 6 days later, 15 miles south-

east of Shipwash light vessel. Lieutenant Nickols, while flying with Lieutenant Munday as his observer in a Short seaplane, sighted the periscope of a submarine. One 230-lb. bomb was released from the seaplane and exploded so near to the submarine that the latter rose half out of the water and turned over on her side before she submerged again. A large number of bubbles continued to rise for some time around the spot where she last submerged. Although it was believed at the time that the submarine was sunk, this is known now not to have been the case, thus giving a further example of the great strength of the hulls of these German boats.

Two days later—on the 17th (May)—while two F.2a flying-boats, *N. 4283* (Captain FitzRandolph, Observer Lieutenant Bell) and *N. 4295* (Captain Cross, Observer Lieutenant Beaver), were out on patrol, they 'heard loud enemy W/T signals' near Terschelling light vessel, but after climbing to 10,000 feet, 'despite good visibility', no enemy craft was sighted. Course was altered, and a submarine, apparently fully blown, was observed heading in an easterly direction 5 miles distant on the port bow of the leading flying-boat—*N. 4295*. Her pilot, Captain Cross, then dived to a height of 1,800 feet, turning to bring the submarine on his starboard bow, and opened fire with the machine-guns aboard—for the flying-boats, being on a long-distance patrol, carried no bombs. One and a half trays of ammunition were fired, and bullet splashes were seen around the conning tower. As *N. 4295* passed over her, the submarine submerged turning to port at the same time. After twice circling the position the flying-boats continued with their patrol, and thereafter returned to the air station. The submarine, according to these pilots, 'resembled the *U.13-16* class, but no lettering was visible on the conning tower'.

The general activity of enemy submarines in the Great Yarmouth area during May is described in the following excerpt taken from a letter written at the time by an officer of the air station:

'Submarines are showing greatly increased activity in sowing mines, and we cannot trace them; they seem to slip in unobserved, lay their eggs and push off again without any one knowing. Then, sometime later, the mines automatically release themselves, and come up to their proper depth. Consequently, for the first time for a good many months, Lowestoft has been getting its mine-sweepers blown up. Additional work has fallen on us, having the areas constantly to patrol to try to catch them stealing into the Channels.'

Sometimes objects which were sighted were described inaccurately as submarines, as the following note, contributed by a Camel pilot, illustrates:

'One day in May, I was ordered to do the Shipwash patrol on a Camel. When almost over the light vessel, at a height of approximately 3,000 feet, I saw what appeared to be a submarine on the surface, or rather, going along with only the *periscope* above water. The visibility was poor, and the submarine, when challenged later, simply did nothing but proceed in a "suspicious manner".

'After an interval, therefore, two dives were made and several bursts given from the two Vickers guns. Whereupon, the supposed submarine disappeared *downwards*, taking cover supposedly. In great glee I turned inland and landed at Orfordness, reporting to Yarmouth, and afterwards to Felixstowe.

'Numerous flying-boats, destroyers, and so on, were sent out from air stations and bases.

'I returned to Burgh Castle and was suitably celebrating my success when I was told by the orderly, "You're wanted on the 'phone, Sir."

'A curt voice (now no longer with us) informed me—"Not to be such a damned fool next time."—My submarine was a whale!'

Pilots from the air station were soon to meet once more the Brandenburg monoplanes in combat. On May 21 one of these machines and two biplanes were seen to be resting on the water in the lee of trawlers, obviously waiting for the flying-boat patrol. On this occasion, however, on leaving the water, they flew away and did not attempt to attack our machine, which was piloted by Captain Leckie (with Ensign Roe and Major Haggerston on board). Nine days later the enemy succeeded, for the first time, in killing a pilot of the air station.

On that morning the F. 2a, N. 4295 (Captain FitzRandolph) and the H. 12, N. 8660 (Captain T. V. Young, D.S.C., and Ensign J. J. Roe, U.S.N.), started off on a long patrol into German waters.

When they were approximately about 30 miles from Borkum Young had to alight with N. 8660 on account of engine trouble. As soon as he had done so, FitzRandolph circled around him, preparatory to alighting if Young signalled that he required his assistance to repair the damage. A few minutes later Young signalled by Aldis lamp that they were repairing the trouble, so FitzRandolph kept on circling over them keeping a look-out for any enemy machines which might appear; he continued to do this for over three-quarters of an hour.

The visibility was not good at the time, and during one of the wide left-hand sweeps of *N. 4295*, her aft gunner saw two Brandenburg monoplanes approaching from aft on the port side, obviously trying to get under the tail of the flying-boat. He reported this to FitzRandolph who waited until he saw the enemy machines himself and then turned to attack them. His second pilot opened fire, but after a few rounds his gun jambed. FitzRandolph continued to chase one of the enemy machines for a quarter of an hour, but found he was not gaining on them, and, moreover, he was being drawn too far away from Young. The other enemy machine, after the initial attempt to an attack, turned away and went at a high speed towards Borkum seaplane station in order, as we know now, to fetch assistance.

Meanwhile, those aboard *N. 8660*—Young's machine—had managed to repair the damage and had left the water and flown on for another three-quarters of an hour until, in Ensign Roe's words, 'at 1.45 p.m. we were again on the water. The entire pumping outfit gave out at this point and we couldn't get the petrol to the gravity tank or anywhere else. Then all hands except Young and myself, got seasick, and even poor Young got a bit groggy. I was pumping petrol by the bilge pump into the small sanitary tins, and from there carrying it to the gravity tank.'

Young did not know his exact position and actually alighted about 150 miles to the north-east of Borkum, and, because he had not been able to inform FitzRandolph of his movements, the latter failed to find *N. 8660*, although he searched the sea, flying a zigzag course, for as long as possible—even coming within sight of Borkum seaplane station—so he was compelled very reluctantly to return to Great Yarmouth air station. When FitzRandolph alighted he had petrol left in the tanks of his machine for another 20 minutes' flight. When he was off Borkum, in his own words, he took 'two photographs of eight German motor launches. Sighted four hostile seaplanes. Came down near the water and got under fire from two trawlers.' He was complimented warmly by the Admiralty for the resource and gallantry he had shown during this patrol.

To return to the conditions aboard *N. 8660* (Captain Young), those in her were still pumping petrol when, in Ensign Roe's words, they 'heard the noise of airplanes. Young told us to stand by, and five hostile seaplanes appeared. It was evident that we were going to make a beautiful target. Young shouted, "What do you think, America?" and I answered, "I am with you."'

What happened afterwards is better told, perhaps, in the words of a German officer who has been good enough to contribute the following note. The account reads:

'On May 30, a fighting squadron, scouting from Borkum, receiving at 2.0 p.m., a wireless signal: "018—enemy aircraft." The squadron immediately set off there and at 3.0 p.m., in 160<sup>γ</sup><sup>1</sup> sighted a flying-boat which had alighted and was recognized as a Curtiss. The Borkum machines circled her at a distance of about 200 m. and a height of 100 m. and opened fire with their aft machine-guns. At once and violently the enemy machine returned the machine-gun fire.

'One of our machines was compelled to return to Borkum with engine trouble. During two encircling sweeps, the flying-boat (whose tracer bullets were seen easily, but which always passed under the tail of our two machines) was shot at by the aft machine-guns of our machines, and then, during a steep dive, the flying-boat was caught under effective fire by the front machine-guns.

'Three of the flying-boat's crew jumped overboard and started to swim. There was a light westerly wind and high swell from the north-west, and the squadron descended and picked up two men of the crew. The third had been drowned. One of our machines went alongside the flying-boat, and her observer succeeded in climbing on board the flying-boat.

'In the back seat he found the mechanic of the flying-boat (who was half-stunned by splinters) and carried him off.

'In the pilot's seat, to port, sat the dead pilot, an English naval officer, with his feet on the rudder bar.<sup>2</sup> The flying-boat was set on fire by a few shots sent into the main petrol tank, for it was not possible to tow or move her. She burned fiercely and sank within 10 minutes.

'The transference of the prisoners was very difficult, owing to the severe rolling of the machines and the danger of damage to the planes; moreover, the possibility of meeting the enemy light cruisers, which had been announced in the morning by *L. 53*, had to be reckoned with by the Borkum machines. The squadron landed at 5.20 p.m., at Borkum with the three prisoners.'<sup>3</sup>

After Ensign Roe was captured, he wrote a letter to a friend at Great Yarmouth air station, and when speaking of the action he said:

'Grant was also knocked unconscious within the first two minutes, and I believe the other had bad luck also. Money and myself remained, and

<sup>1</sup> Another German account gives this position as '110 ε'. See map, facing p. 160.

<sup>2</sup> Captain Young.

<sup>3</sup> The German officers who took part in this attack were Oberleutnant Freudenberg, Oberleutnant Engelhardt, Fliegerleutnant Pieper, Fliegerhauptmann Redilius, Fliegerleutnant Eichenauer, Fliegerleutnant Ecke, Fliegerleutnant Tellmann, Fliegerhauptmann Rumpelt.

we did our best and then had the usual "jams". Money was mighty plucky under fire and deserves a lot of credit. The final result was that the machine was destroyed by fire, and they picked Money, Grant (I don't know where they found them) and myself out of the water. I got a little crack on the knee and under the arm, but I was mighty fortunate, and I don't see why I wasn't killed with Young as I was right alongside him.

'I tried to do something for him, but could only assist him slightly as he was so badly hit. After 25-30 minutes in the water, in which my lifebelt failed me and had a time in trying to get rid of my boots and dodge bullets, I was picked up by a German seaplane and taken to Borkum. Young and the other chap,<sup>1</sup> whose name I cannot remember, are "done in". I do not believe much was gained except the destruction of the machine. I want to say a good word for the men. First of all Young, and then Money.<sup>2</sup> They were mighty fine.'

As soon as he was attacked Captain Young released a carrier pigeon (N.U.R.P. 17 F.N. 3698) bearing the message, 'On water, attacked by 3 Huns'. This was brought to Great Yarmouth air station by the bird, who flew the distance of approximately 200 miles in 5 hours, but although numbers of machines left the air station immediately to search for the flying-boat, no trace was seen of her.

One of the searching machines was a flying-boat piloted by Captain Leckie; the second pilot was Captain Fetherston and the gun-layer Lieutenant Comstock. They saw no sign of Young's machine, and it was dark by the time they started on the return journey. It was a moonless night, and Fetherston piloted the machine back from the German coast to Great Yarmouth Roads. Through a mistake the coastal lights were not lit, and Leckie alighted by the aid of petrol flares which were placed along the beach in front of the air station. Apart from the skill shown by Fetherston<sup>3</sup> and Leckie this flight is of historic importance, as it was the first time that the North Sea was crossed at night by a seaplane, and the first time also that a pilot alighted successfully with a flying-boat at night.

Unfortunately for Ensign Roe, a carbon copy of the message borne by the carrier pigeon released by Captain Young was found on the former by his captors, and he was taken before the German Military Governor of Belgium, who was furious at the use of the word 'Hun', and even threatened him with very severe punishment.

<sup>1</sup> Private W. Chase.

<sup>2</sup> Private J. N. Money.

<sup>3</sup> A short time after this episode His Majesty the King awarded this officer the Distinguished Flying Cross in recognition of his services.

The same day that the action of May 30 was fought, an experiment of far-reaching importance was made off Orfordness, namely, the release of a Camel from a lighter towed behind a destroyer. For some time the flying-boats operating from Felixstowe air station had been transported into German waters on lighters towed by destroyers, in order that the radius of action of these machines could be increased, as they did not have to consume their own fuel while being towed.

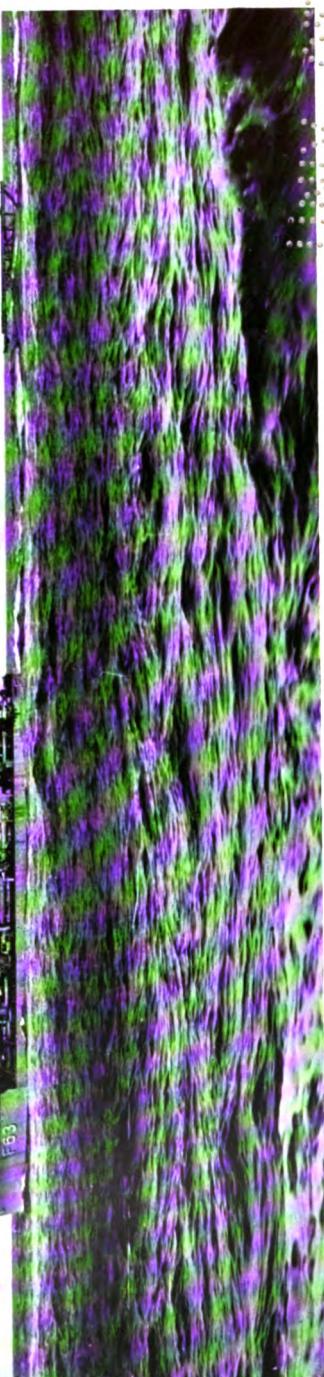
These lighters (which owed their origin largely to Lieutenant-Colonel John Porte) were built of steel with a stepped hull, and were of such an efficient form that they could be towed at 30 knots by a destroyer. The general section was channel-shaped, with flooding tanks on each side of the hull. When it was desired to carry a flying-boat in one of these lighters, the tanks were flooded partially. The machine was then warped into the hold and, when in position, the water was blown out of the flooding tanks by compressed air, thus enabling the lighter and flying-boat to be towed at will.<sup>1</sup>

Useful as this device had proved, it was found, speaking generally, that the flying-boats were unable to attack the Zeppelin airships that maintained such an efficient patrol in Helgoland Bight, insomuch as the Zeppelin airship had ample time to elude the flying-boat. The result was that the movements of our naval forces were hampered, especially as few of them carried aircraft on launching rails on their gun-turrets.

To meet this difficulty Lieutenant-Colonel Samson had a 30-foot deck made to fit on one of the towing lighters, and on this, held in place in the flying position, was a Camel. The proposal was that a destroyer, in company with the rest of her flotilla, should tow such a lighter with its machine into the enemy waters. Should hostile aircraft (either airships or seaplanes) be sighted, the pilot would jump into the Camel, the engine would be started, and as soon as it was running 'full-out' the pilot would pull a 'quick-release' gear. Then, by virtue of the fact that his machine was already in the flying position and was being towed at a speed of about 30 knots, he and his machine would leap into the air.

On May 30 the first trial was made off Orfordness in the presence of several officers, including Lieutenant-Colonel E. D. M. Robertson, the commanding officer of Felixstowe air station.

<sup>1</sup> The proposal to use lighters for this work was made in 1916. The first trials were made off Calshot in February 1917, and the first experiments in the North Sea were made from Felixstowe air station on September 3, 1917.



DESTROYER TOWING A LIGHTER AND SOPWITH CAMEL.

6. d  
25  
82

Major Cadbury was aboard the lighter, and, at the time, he described the trials as follows:

'In spite of advice from those concerned, Samson would insist on fitting skids instead of wheels to the undercarriage of the Camel. These skids fitted into grooves which ran along the whole length of the lighter on a specially rigged-up stage. Samson's idea with regard to the skids was to keep the machine straight and prevent it toppling over the side of the lighter before it gained sufficient flying speed. As you can well imagine, if the skids happened to jump the grooves they landed on the frame of the staging and had, of course, a very rocky run. This is what happened, and was one of the causes of the failure which nearly turned into a tragedy. . . . We were doing about 32 knots when Samson and machine fell over the bows, and the lighter went over the lot. I gasped, and could not believe it possible that Samson could avoid being battered to atoms. It was all over in a second, and before I had regained my legs, the wreckage of the machine was 300 or 400 yards astern, and no Samson. Suddenly, up bobbed a little white flying cap, and all heaved a sigh of relief.'

'An escorting destroyer<sup>1</sup> had got a whaler away in about 30 seconds, and picked him up. He was unhurt, but had had a nasty time under the water disentangling himself from the wires of the wreck. The first thing he said as he ran nimbly up the side of the destroyer was, "Well! Robertson, I think it well worth trying again. . . ."

'The second cause of the failure was that the tow was not long enough between the destroyer and the lighter, and therefore the destroyer blanketed, to some extent, the lighter.'

'The third and last cause, which was probably the most important, was that the destroyer did not keep absolutely head on to wind. This is proved by the photograph, in which you will notice that her smoke denotes that the wind was on her port bow. This meant that Samson, in running along his grooves, was slightly out of the wind. The machine, therefore, tended to veer to port, and finally crashed over the port bow. The reason why the destroyer could not keep head to wind was due to the fact that it took her Commander rather longer than he anticipated to work up to his 32 knots. Due to this he had to alter his course slightly, in order to miss some shoals or sand-banks.'

'In order to show how blanketed we were by the destroyer, Samson could not get the tail of his machine to lift. I therefore climbed right astern of the staging, and, lying on my back under the machine, lifted his tail up with my feet, so that when he slipped the mooring line from his machine, his tail was in the air. By the time I had lowered my feet and turned round, hanging on like grim death, Samson had gone.'

The experiment was tried again some time later and was a complete success, but this time a Camel with an ordinary wheeled

<sup>1</sup> The destroyer towing the lighter was the *Truculent*.

undercarriage was used. On the occasion of the first experiment, the flying-off deck was horizontal to the water, with the result that when the lighter was being towed at a high speed, the deck rose at too acute an angle. Subsequently, acting on Vice-Admiral Tyrwhitt's advice, this deck was tilted towards the bow at such an angle that it was horizontal to the water when the lighter was being towed at full speed.

It may be remembered that on May 30 Captain Young had been killed and the flying-boat *N. 8660* set on fire. This victory naturally elated the enemy, and during the week following the action, wireless telegraph 'squeals' were intercepted frequently, and interpreted as coming from enemy airships. By the aid of directional wireless apparatus it was deduced that the position of the senders was off the Texel.

Now at this period it was very unusual to find hostile airships so far to the west (flying-boats from Great Yarmouth and Felixstowe air stations had rendered such a patrol inadvisable), so it was thought that these signals were a ruse on the part of the enemy to lure our machines into their waters, and then attack them in overwhelming numbers.

During the first week of June, Lieutenant-Colonel Samson, following a suggestion made by Captain Leckie, decided that a squadron of 5 flying-boats (made up of 2 machines from Great Yarmouth and 3 from Felixstowe air stations) should, in the words of one of their pilots, 'go over and deal with the situation in the appropriate manner'. The machines from Great Yarmouth were the *F. 2a*, *N. 4295* (Captain Leckie, Captain Bolton, Major Haggerston, Private Deeley W/T, and Private Chapman 'E') and *N. 4298* (Captain John Hodson, Captain Mossop, Private Taverner G/L, Corporal Beaumont 'E', Private Raymond W/T); they were under the command (as was the whole squadron) of Captain Leckie. The machines from Felixstowe were *N. 4302* (Captain Barker, Lieutenant Galvayne, Ensign Keys, U.S.N., Private Hopkins W/T, Private Reid 'E'), *N. 4533* (Captain Dickey, Captain Paull, Lieutenant Hodson, Private Burton 'E', Private Russell W/T), *N. 8689* (Ensign Eaton, U.S.N., Lieutenant Duff-Fyfe, Lieutenant Patterson, Private Stevens 'E', and Private Brown W/T).

On June 4 the machines were assembled at the two air stations respectively, and just before 1.0 p.m. the two Great Yarmouth machines left the Roads, and a quarter of an hour later they met

their consorts from Felixstowe, formed into a Vee-formation, shaped a course for the Haaks light vessel, and so 'Cheerily to sea, the signs of war advance'.

At this period, in accordance with Admiralty instructions, it was the standard practice for a flying-boat when on patrol to transmit a wireless telegraphic message every quarter of an hour to her base, but on this occasion Captain Leckie forbade the sending of such messages except by one machine, in order not to disclose his strength to the enemy. This course was followed afterwards on all occasions when flying-boats were outward bound.

After flying for two and a half hours, the north Dutch Islands were sighted, and the squadron continued on an easterly course with the islands on the starboard beam at a distance of about 10 miles away. So far the flight 'had been holiday flying at its best'. The eastern end of Terschelling Island was reached at 3.15 p.m., and course was then altered to the north-west, and the squadron continued to patrol on a limited northerly and southerly line with the object of intercepting any enemy aircraft which might be in the vicinity; 'but so far there had been nobody to greet us. Still, even if our friends the enemy would not add to the gaiety of nations, the squadron itself was still capable of creating some form of incident—and did.'

At 3.30 p.m. one of the Felixstowe machines—*N. 4533* (Captain Dickey)—was seen to alight about 10 miles north of Terschelling Island. As soon as his machine was on the water he signalled by Aldis lamp that a petrol feed-pipe to one of his engines had burst, so that the engine could not be used, and with only one engine and the short steep sea that was running, he could not hope to leave the water, let alone fight. Captain Leckie, therefore, signalled him to 'taxi' into Dutch territorial waters, beach his machine and burn it before being interned with his crew, and this he was able to do ultimately.

Twenty minutes later—at 3.40 p.m.—'the dear old Borkum crowd turned up—five seaplanes from the east—bless their dear little hearts!' The squadron, led by Captain Leckie, immediately turned to attack them, but the enemy seemed to be more anxious 'to shoot Dickey up on the water' than to engage the squadron, and, aided by their superior speed, they kept out of range, and one machine was seen to detach itself from the flight and fly towards Borkum, presumably to summon reinforcements. This presumption was found afterwards to be

'A fighting squadron from Borkum air station met 5 hostile flying-boats in Square 004 e.<sup>1</sup> On approaching them, one of them was seen to alight.<sup>2</sup> When the squadron attempted to attack this machine, the other four attacked it (the squadron) with great vigour. It had to retreat and was chased. Soon the flying-boats turned aside and the squadron followed them again. This manœuvre of retreat and pursuit was performed a second time.'

For the next three-quarters of an hour the flying-boats circled around Dickey's machine ('the lame duck that was making good headway'), whiling away the time, in the words of one of their pilots, 'with periodical short pursuits of the enemy. Waiting for the storm—the arrival of the supporting machines from Borkum.' This went on till 4.30 p.m., during which time the enemy attempted twice to attack Dickey on the water, but would not join combat with the other four, for, in Leckie's words, 'they made every effort to get out of our way, and only once did we get within effective range'.

By 4.30 p.m. the enemy's reinforcements appeared—'a compact swarm of black specks seen on the eastern horizon, which rapidly approached and proved to be about 15 or 16 seaplanes flying low, and apparently in 3 squadrons of 5 machines each'.

Unfortunately, the German account does not specify the number of machines, merely stating that the 'flying-boats met another squadron sent to the German aid'. Another account states that the number of pilots was fourteen.

As soon as these machines were seen, Leckie signalled for the flying-boats to attack them, which they did in Vee-formation. Unfortunately only three did so (*N. 4295*, Captain Leckie, *N. 4289*, Captain Hodson, and *N. 4302*, Captain Barker), for the pilot of one of the Felixstowe machines, Ensign Eaton, U.S.N., in *N. 8689*, had not broken off the pursuit of some of the enemy machines which, previous to the arrival of their reinforcements, had been attempting to destroy Dickey's flying-boat. He paid for his enthusiasm with the capture (by the Dutch authorities) of his machine, and he and his brother officers and crew spent the rest of the War in an internment camp in Holland.

Leckie, undaunted by the strength of the enemy, elected to meet them head on, and, in the words of a pilot of his squadron,

<sup>1</sup> Near Stortmelle Gat. See chart facing p. 160.

<sup>2</sup> This remark is not quite correct, as *N. 4533* (Captain Dickey) had been on the water for some considerable time before the enemy appeared.

'he went hell-for-leather for them, and drove clean, slap-bang through the enemy formation, splitting it right up, carrying away the wireless aerial of his boat on the top plane of the leading enemy machine'. Leckie then led his machines to port, in 'line-ahead', cutting off three enemy seaplanes which formed the enemy's right wing. At the same time these machines received a heavy and concentrated fire from the bow guns and, a few seconds later, from the port guns of the flying-boats. The reply from these three enemy machines was ineffectual, and they turned seawards. As Bolton said subsequently:

'The observer in the nearest machine at first returned our fire very hotly and accurately, their tracers were all round us. Three shots passed between Haggerston, Leckie, and myself, missing us by inches only, and lodged one above the other in the centre interplane strut. Another shot, presumably from this machine, smashed our petrol sight feed-glass, but did not do any damage. We fairly pumped lead into the three machines we cut off, and whether the guns jammed or whether we hit the observers (most likely the latter) the guns of these machines were completely silenced.'

Leckie now circled around the enemy who 'were in their allotted positions in the centre'. The action was now at its hottest, for, as Mossop said: 'Everybody seemed to be firing away like blazes, and the air was thick with the smoke from tracer bullets which looked just like the paper streamers people chuck about at dances'. The pilots had a strenuous time, 'sweating blood, following Leckie, who was in and out, all over the place, roaring the Huns up—besides we all got bumped like blazes from slip-streams'.

During this phase of the action Major Haggerston (in Leckie's machine) had a lucky escape, for a tracer bullet 'passed where his moustache should have been'; he said afterwards that 'it had a horrid smell'.

The enemy soon began to suffer losses. One enemy seaplane tried to get under the tail of Hodson's machine, but 'it was shot down . . . was seen to side-slip, and spin into the sea, and there is little doubt it was destroyed'; its fate was observed also by Leckie and his crew. Bolton, speaking of Hodson's successful attack, said, 'the enemy machine was at the head of the Vee. On passing only a few feet beneath us he came into practically point-blank range of Hodson's rear guns. There is no doubt whatsoever of his destruction, as four days later the wreckage of the machine—a single-seater—was washed ashore on the coast of Terschelling or Ameland, and the pilot, a German officer, was found with a

bullet through his heart. This report was extracted from a Dutch Report and published in the press a week or two later.' Another seaplane attacked Leckie's machine and suffered a similar fate.

Naturally, it was impossible for those concerned to appraise accurately the general situation, but about this time Ensign Eaton, U.S.N., was seen to alight with 'a terrific splash between the Islands of Terschelling and Ameland', for he had been forced down by the enemy. When last seen, just before 5.0 p.m. (by Captain Hodson), a Dutch trawler was standing by his machine, which was surrounded by between 50 and 100 fishing vessels. The crew and machine were seized by the Dutch authorities, and the former interned.

The enemy scored another success, for Lieutenant Galvayne (in N. 4302) was shot through the head and killed instantly, and a little later the pilot of this machine (Captain Barker) was compelled to alight (between Ameland and Vlieland in the Zuyder Zee) owing to a broken petrol pipe. There was considerable danger of him and his crew being interned, but through 'the particularly good work' of his engineer, Private Reid, a temporary repair was effected, and the machine was able to return safely to the air station. Hodson also experienced trouble with one of the engines of his machine, but managed to fly on one engine while the repair to the other was being effected.

By this time the enemy had been 'thoroughly discomfited', and those of them that were left broke off the engagement and returned eastwards—their superior speed preventing the flying-boats from catching up with them. Leckie then signalled the flying-boats to turn homewards. By this time Barker had managed to get his machine into the air again, and for a few minutes Hodson followed him, thinking his machine was Leckie's, until the mistake was discovered. It should be stated that, with the exception of Hodson's machine (which 'was terrible in appearance, painted post-box red, with yellow lightning marks running diagonally across her'—for he 'fondly hoped that this would put the wind up the Hun'), all had plain, varnished hulls, so that it was very difficult to distinguish one from the other.

At 9.10 p.m. in the evening, the three machines, piloted by Captains Leckie, Hodson, and Barker, alighted safely in Great Yarmouth Roads, bearing with them their only casualty—the dead body of Lieutenant Galvayne sitting beside Captain Barker. No machines were lost belonging to Great Yarmouth air station, but two were interned of those belonging to Felixstowe air

station. Two of the enemy's machines were shot down—they were seen on the water by all the members of the flying-boat squadron—and it was learnt afterwards from Ensign Roe that he had been told, when a prisoner at Borkum air station, that altogether the enemy lost six machines during this action. Captain Dickey, despite his predicament upon the water, caused fire to be opened on the enemy, with the result that one of their number was forced to alight, and was afterwards destroyed by fire by another machine that alighted alongside and rescued the pilot.

So ended the greatest action that was fought between seaplanes during the War. The flying-boats, after having flown for nearly 3 hours, fought an action 'right on the enemy's doorstep', and defeated him, despite having their strength reduced by 40 per cent. at the outset. The enemy's tactics and strategy were sound in that they endeavoured to bring about an overwhelming concentration of numbers, but they were defeated by the leadership and tactics of Captain Leckie and by the pilotage and gunnery of the officers and crews under him.

The particular account already referred to, contributed by a German officer, does not, unfortunately, give any details of their losses. Starting with the arrival of the main body of the enemy from Borkum (at 4.30 p.m.), it states:

'They<sup>1</sup> at once attacked the enemy, and having come within range, a cross fight on the port side was carried on, which gradually became a circular combat. The aft machine-gunners of the two flying-boats were put out of action, but the machines were followed in vain till the jamming of the fixed machine-gun forced the squadron to retire. In the meantime, the other squadron had an opportunity of firing on the machine on the water, until the combat had to be interrupted for lack of petrol, and the flying-boat was able to taxi close to land. It was again fired at by seaplane 2239 with her free gun, and, about 300 yards from the western edge of Terschelling, she burst into flames.<sup>2</sup> Three men of the crew reached the land.'

We learnt much from the results of this action, and, above all, how necessary it was for the flying-boats to be mechanically perfect. Three machines were temporarily incapacitated (and one

<sup>1</sup> The German officers who took part in this action were Oberleutnant d. R. Eichler, Fliegerhauptmann Bartsch, Fliegerleutnant Pülsen, Oberleutnant Hartlieb, Oberleutnant d. R. Blanche, Fliegerleutnant Pieper, Fliegerhauptmann Doll, Fliegerleutnant Christiansen (not the Christiansen), Fliegerleutnant Heddans, Fliegerhauptmann Gobel, Fliegerleutnant Risch, Fliegerhauptmann Lohmann, Fliegerleutnant Tellgmann, Fliegerhauptmann Elser.

<sup>2</sup> She was deliberately set alight by Captain Dickey.

lost for ever) due to the breakage of petrol pipes—as Captain Leckie pungently reported after the action, 'It is obvious that our greatest foes are not the enemy but our own petrol pipes'.

As a result of this action it was decided that all flying-boats should have their hulls 'dazzle-painted', primarily with the object of being able to distinguish them clearly in the air, so that a pilot could, in a 'dog-fight', know at a glance who was in a particular machine—knowledge frequently of considerable value.

Pilots were allowed to paint their machines as they desired, and as a result the bizarre was not lacking.

The rest of the first week of June brought more fighting, for, on the 5th, an H. 12 flying-boat from Felixstowe air station (with the commanding officer—Lieutenant-Colonel Robertson—and Major J. O. Galpin on board) was shot down as a result of an action fought with 5 enemy seaplanes from Zeebrugge air station. The flying-boat was forced to alight at sea (due to the damage inflicted on the port engine) and was totally wrecked, although her officers and crew were saved, after they had been clinging for nearly 8 hours to the keel of the up-turned hull. This action was distinguished by the sportsmanship shown by the enemy. As soon as the H. 12 was on the water, one of the German machines alighted, taxied up to the boat and hailed Lieutenant-Colonel Robertson, and told him he was near our coast, and asked him whether he would like to be taken into Zeebrugge or whether he would rather wait and trust to luck that some of our machines would pick him up. Lieutenant-Colonel Robertson thanked him but elected to cling to the wreckage of the H. 12, whereupon the German pilot (it is believed that it was Fliegerhauptmann Walker) took a photograph of him, waved a cheery farewell, and flew away back to Zeebrugge.

Three days later (the 8th) the enemy scored a success over machines from Great Yarmouth air station. One of the 'Dawn Patrol' machines on that morning was a B.E. 2c, flown by Lieutenant G. F. Hodson. At 5.30 a.m., when 5 miles south-east of Cross Sands light vessel, he saw 5 Brandenburg monoplanes from Zeebrugge air station on the water. They left the water as soon as they sighted the B.E. 2c, and proceeded to attack the pilot and machine, which was not equipped with a machine-gun but only bombs; luckily he was able to elude the enemy's fire and made good his escape. A few minutes later a Short seaplane appeared on the scene (also from Great Yarmouth) piloted by Lieutenant R. W. A. Ivermee, with Private Bourne as his

observer. The enemy then suspended the attack on the B.E. 2c and turned to the seaplane which, hopelessly outclassed, was soon compelled to alight upon the water near two motor launches. The enemy machines then circled around the seaplane, pouring a heavy fire into her, despite a counter attack from the two motor launches of the Auxiliary Patrol Service. Both Ivermee and Bourne were forced to jump into the sea, where they clung to the floats, continually ducking their heads under water to avoid bullets. The seaplane sank soon and the enemy then withdrew, leaving her late pilot and observer, who had sustained flesh wounds, to be rescued by the motor launches. The latter had not escaped unscathed, for a shot from one of the enemy's machines was the cause of serious damage to the engine room of one of the launches. The victorious enemy machine was piloted by Oberleutnant Scheurlen.

The enemy made a practice, apparently, at this period of lying off Great Yarmouth in the very early hours of the morning, waiting to pounce on any lone machine they saw, but they never again scored the same success as they did on this day.

A few hours later (on June 9) an enemy submarine was bombed by a flying-boat from the air station. Captain Bolton and Ensign Teulon, U.S.N., were flying in F. 2a, N. 4512, and when they were 5 miles south of Smith's Knoll pillar buoy they sighted 'a submarine right ahead on the surface about 5 miles distant . . . apparently of the *U. 51-56* class'. They dived to the attack and dropped two 230-lb. bombs (the first of which failed to explode) in her wake, but with no visible result.

It will be noticed that this submarine was sighted 5 miles away. Various aspects of attacks on submarines by aircraft had been analysed about this time, and it was found that, taking a period of about one year, the average distance at which submarines were sighted from aircraft was just under or just over 5 miles. It was slightly more on the west and a little less on the east coast. On the east coast about 81 per cent. of enemy submarines, when sighted, were travelling awash, and 19 per cent. with the periscope visible, but by the time the machine arrived over them, in 73 per cent. of cases they were submerged totally.

Some idea of the extent of anti-submarine patrolling by aircraft may be gathered when it is stated that during this month (June) considerably more than half a million miles were flown by aeroplanes, seaplanes, and airships engaged in this work from coastal air stations.

June finished with another combat between flying-boats and Brandenburg monoplanes. On the 30th 5 of the former craft (three of which were from Felixstowe air station) under the command of Lieutenant-Colonel Nicholl were off Ameland, when they sighted 5 Brandenburg monoplanes who 'immediately turned tail and fled'.

Now Lieutenant-Colonel Samson had given implicit instructions that flying-boats were, under no circumstances, to break formation, 'so there was nothing for it but to go after the seaplanes'. The latter promptly scattered, and so the flying-boats were left 'to chase one poor, lone Hun', who flew along the coast of Ameland, right inshore, thereby violating Dutch neutrality and so causing the flying-boats to break off the action.

Owing to the growth of the air station at this period, it was found necessary to enlarge the scope of the duties of the night landing-ground at Burgh Castle. The officer commanding this station at this time was Captain G. W. R. Fane, D.S.C., and, writing of the activities of his command, he states:

'As Yarmouth air station grew, the number of aeroplanes became greater than the aerodrome was really capable of accommodating, and so three hangars were erected at Burgh Castle and a flight of Camels and D.H. 4's were sent there, and I was given command of the station. I had 7 pilots, all of whom were particularly keen, and I set out to train them as well and as quickly as I could to the various patrols which had to be done daily. Owing to the distances out to sea which had to be covered, it was deemed advisable to go in pairs, although the losses the station sustained through engine failure amounted to one only.'

'To show the speed that the Germans had attained with their float seaplanes, I had gone out one morning in company with another Camel and, after cruising between the Shipwash and the Sunk lightships, I sighted two seaplanes about 16 miles off, the identity of which I was uncertain, so I proceeded to investigate more closely. I missed the Camel who was with me, I presume a cloud had separated us, so I went on alone. They evidently spotted me when I had got to within about 5 miles of them, then they went for home. My air speed was 89 knots, and in 40 minutes I don't think I gained more than 2 miles, and I had to give up as they disappeared into some sea fog and I set a course for the Kent coast, landing at Dover after 2 hours and 25 minutes. I only had about 10 minutes' petrol left.'

Two officers were killed during this month—Second Lieutenant C. C. G. Nickols on the 9th, and Lieutenant R. C. Packe on the 21st; the former stalled when flying in a Short seaplane, and his machine spun into the water. The observer was saved,

but Nickols was entrapped in the wreckage and was drowned before he could be rescued. Packe 'fell into the sea in his Camel, when on patrol about 8 miles out, and before assistance could reach him he was drowned . . . he was a splendid fellow and our loss is irreplaceable, but it is asking for trouble, sending land machines out to sea. This is about the 23rd or 24th fatal casualty through active service in just over 2 years—a pretty large casualty list, considering the smallness of the station up till just recently.'

July was a month of bad weather which interrupted all aerial work considerably. The main feature of the aerial activity in the North Sea during the month may be said to have been a decrease in enemy airship activity and a marked increase in the activities of the Flanders coast air stations, namely, Zeebrugge and Ostende.

On July 6 Oberleutnant Christiansen, with a flight of monoplanes, attacked off Harwich one of our submarines—*C. 25*—while she was awash, with bombs and machine-gun fire. The commanding officer, Lieutenant Bell, R.N., and 5 ratings were killed, and the pressure hull pierced, so that the submarine was unable to submerge. She was towed into port by another submarine despite a second attack made on them by the hostile machines.

Twelve days later (the 18th) the enemy followed this success by attacking, with 7 machines from Zeebrugge, 2 Short seaplanes from Westgate air station which were escorted by 3 Camels from Manston air station. The seaplanes were shot down and the pilots killed, and the enemy made good their escape.

Our score against the enemy was levelled a little on the 19th of this month (July), for on that day a raid was made on the Zeppelin airship sheds at Tondern by Camels flown from the aircraft-carrier *H.M.S. Furious*, the flagship of the Admiral Commanding Aircraft of the Grand Fleet. As a result of this raid two of the sheds were wrecked, and the airships *L. 54* and *L. 60* which were housed in them were destroyed.<sup>1</sup>

After this success the weather broke and prevented much flying being done at Great Yarmouth air station until the end of the month, when the enemy scored another success, for 5 Brandenburg monoplanes from Zeebrugge, under the command of Oberleutnant Christiansen, attacked and destroyed a flying-boat from Great Yarmouth air station. The machine was the *F. 2a*

<sup>1</sup> Vide *The German Air Raids on Great Britain, 1914-1918*, pp. 194-6.

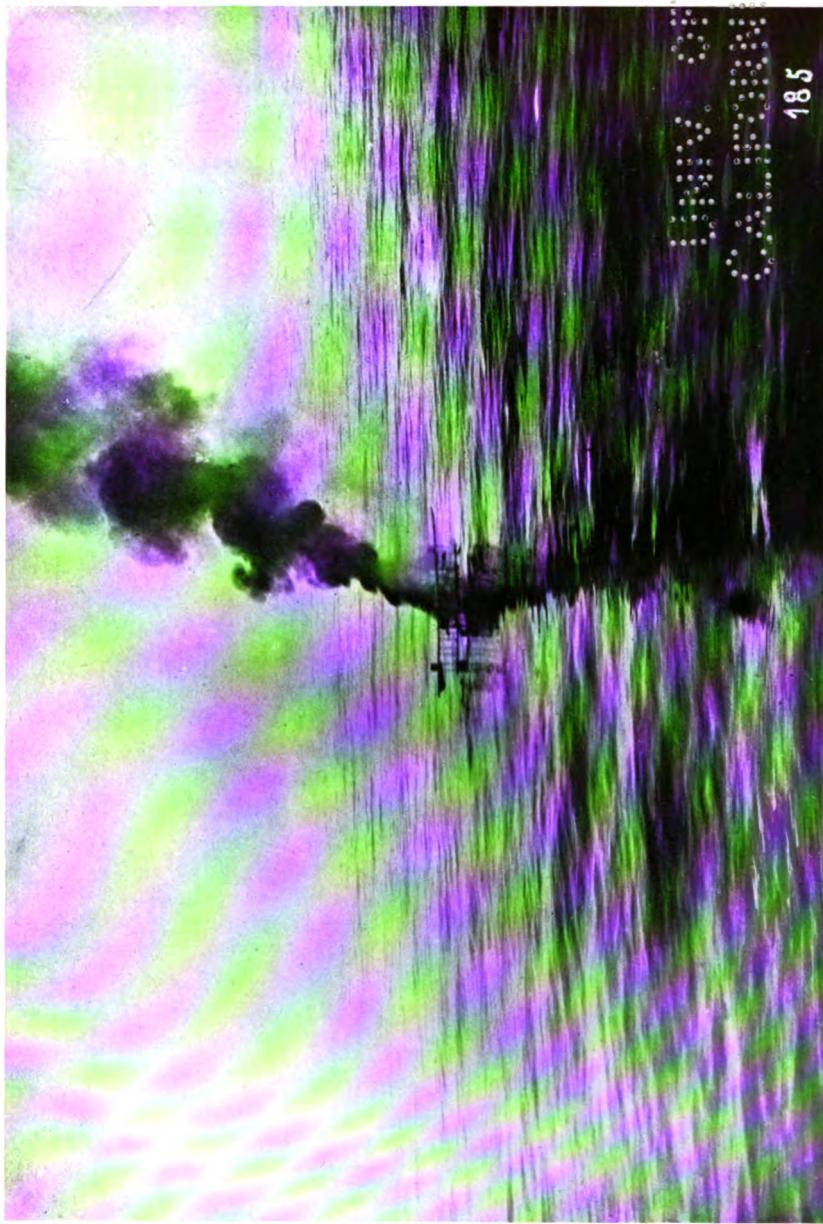
*N. 4305*, and aboard her were Captain E. A. Mossop, Lieutenant G. Hodgson, Private Cooper ('E'), Private Dingley (W/T), and Private Greenwood (G/L), and she, in company with two D.H.9's, left the Roads in the evening on a routine patrol out to Smith's Knoll area. What happened after the flying-boat left is told by Captain Mossop in the following words:

'We took off about 6.0 p.m., and after circling near the station to let the D.H. 9's take position on us, we received the signal to proceed, but unfortunately, as it turned out, only one D.H. was with us. We proceeded to Smith's Knoll, which was to be the fulcrum of our patrol.

'We had gone east for a while and then due south and were turning west when we saw two machines on our starboard bow. At first I thought they were the two D.H.'s coming to join us, but on our port bow, below us, were three others which we recognized as German monoplane seaplanes. These we knew to be much superior to us in speed and manœuvring ability and that our only hope was to get down close to the water.

'I opened full out and put the nose down, the air-speed indicator crept up to 90 knots and the wires were whistling. The two enemy machines on our starboard bow came straight at us and opened fire, the first burst getting home, for Dingley, who was at the double bow-guns, crumpled up and fell into the bottom of the boat. The three on the port bow went round and on to our tail, where they were joined by the first two. From my seat I could not see them behind me, but they opened fire again and the bullets whistled near us, accompanied by a disconcerting "crack-crack" as they hit the machine. The seat between Hodgson and me was ripped by one shot, and it is a wonder none of us were hit. I knew that to turn was fatal, so carried on and trusted to luck which, however, was not for long, as both engines slowed down and stopped, and we were forced to land. The gravity tank in the centre section of the top wing had been badly holed and the petrol pumps could not keep up with the leakage. Luckily, the sea was smooth and we landed safely, had we bounced we would probably have crashed. As soon as possible, we examined poor Dingley, but he was dead, shot through the neck.

'I wrote out a pigeon message and sent off one pigeon, and was writing a confirmatory one to send with the second bird, when the enemy came at us again, appearing to be flying in line ahead. They opened fire, and, as the shots were hitting the machine, I ordered the crew on to the wing tips, as I knew the body of the boat would be their target, but before we could scramble out, the petrol tanks were hit and set on fire. The engineer, Cooper, went through the body of the boat and must have been hit, for we never saw him again. We heard no shout or scream, so I concluded he must have been mortally wounded. The heat of the burning petrol and the exploding machine-gun ammunition prevented us from getting back into the hull. The gunlayer—Greenwood—got burnt about the hands and face and damaged his lifebelt and must have jumped into the sea, for he appeared



CAPTAIN E. A. MOSSOP'S FLYING-BOAT BURNING ON THE WATER.  
This photograph was taken from one of the German machines.

1  
2  
3  
4  
5  
6  
7  
8  
9

round the bow of the boat and sank. Hodgson and I let go of the wing and swam to him and held him when he came up. After a struggle in which he ducked us both in turn—he could not swim—we managed to quieten him and let him know that we would do our best for him. A man who has just escaped fire and is now in danger of drowning is likely to be a little excitable, but he was very brave and this helped us.

'The machine was soon a blazing inferno, and we saw the observer of the last enemy machine that flew over us stand up and take a photograph of her, and it was not long before all signs of her had disappeared, but it left a threatening legacy—a large patch of floating petrol which was burning. Thanks to it being calm, we were able to swim away from it.

'There is nearly always a humorous side, even to some tragic events, and the following will illustrate what I mean—Hodgson, the gunlayer, and I were in the water, all rigged up with helmets, goggles, &c., like three "air-men" with no machine to fly. Hodgson's gear was *drawn from stores*, and was quickly discarded and floated away. *Mine remained on my head—they belonged to me!*

Hodgson and I took it in turns to support our less fortunate gunlayer, while the other took off his boots, which made it easier to tread water. I happened to have my brandy flask in my pocket and there—all alone in the North Sea—at least, that is what it seemed like to us—we each had a drink of its stimulating contents—a case of putting spirits down to keep spirits up!

'At first we could not see anything on the horizon, which to us, with only our heads above water, was very small. Presently, we saw smoke, then the tops of a mast, the top of a funnel, belching large volumes of smoke. We felt happier, for we knew that some ship was racing to our rescue. It seemed an eternity before the *Halcyon* came fully into view,<sup>1</sup> and even longer before she was alongside and had launched a boat. A number of her crew were lining her deck and gave us a cheer, and our gallant gunlayer, Greenwood, cheered in answer, but we told him in a few polite and nicely chosen words to reserve his breath until we were safely on board.

'The ship's doctor took charge of us and we were supplied with dry clothing and made comfortable through his kindness and that of the Captain and his officers, to whom we really owe our lives, as we could not have remained afloat much longer. We arrived back at Yarmouth before midnight, unhappily a smaller crew than we had set out, for both Cooper and Dingley had found a watery grave.'

Before describing the sequel to this action it must be said that both officers were commended for the coolness they had displayed in the combat, and for their gallantry in saving the life

<sup>1</sup> The captain of the *Halcyon* actually witnessed the whole attack, for at 6.16 p.m., he signalled Lowestoft Naval Base: 'Urgent—Five seaplanes bearing south steering east.' This was followed by another one 10 minutes later, reading: 'Urgent—seaplanes attacking flying-boat,' followed by yet another at 6.41 p.m., reading: 'Seaplanes going east. Flying-boat in flames. Am rescuing.'

of Private Greenwood, who could not swim and whose lifebelt would not inflate. Considering the ordeal that they had been through, it was no mean feat to support a struggling and nervous man in the water for 35 minutes, hampered as they were by heavy clothes.

The pilots of the two escorting D.H. 9's had only just joined the air station, and were inexperienced in fighting and navigation over the sea. They left the Denes at the same time as Captain Mossop left the Roads, but unfortunately a flying-boat from Felixstowe air station was passing Great Yarmouth at the same time, and one of the D.H. 9 pilots mistook this machine for Captain Mossop's, and followed it to Cromer before he discovered his mistake, when he returned to Great Yarmouth. The other machine escorted Mossop until he was attacked, and then, seeing that he was outnumbered, unfortunately turned about and returned to Great Yarmouth. Had these two officers been able to remain with the flying-boat the result of the action might have been very different.

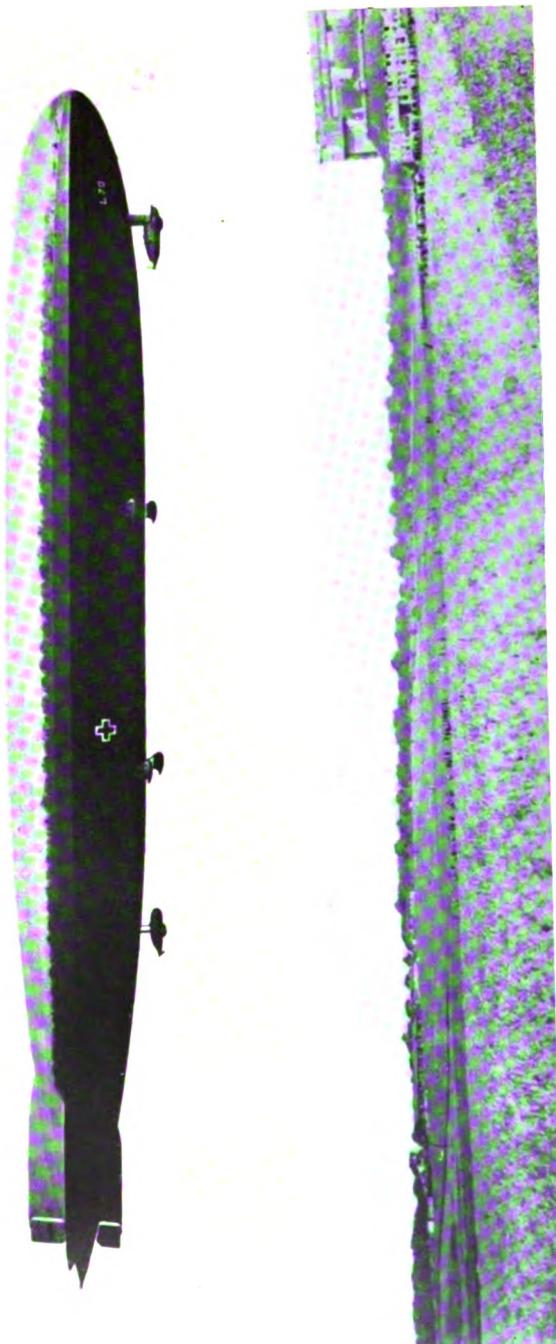
The enemy machines were sighted just before 6.0 p.m. by H.M.S. *Melampus*, who signalled the fact to H.M.S. *Forth*, and the news was retransmitted to the commodore at Lowestoft, who ordered all available machines from the air station to go to the attack. Unfortunately their pilots never sighted the enemy.

According to an account published in Germany at the time, the enemy, after leaving Zeebrugge, made for the North Hinder light vessel, then altered course westwards until they were over the Sizewell Bank (near Aldeburgh), whence they flew up the coast past Lowestoft until they met Captain Mossop. On their return journey they flew on a south-easterly course to the east of the North Hinder light vessel, carrying on from there to the Schoewen light vessel (off the mouth of the East Schelde), and then to the westward, home to Zeebrugge. These courses are of importance, for they explain why machines that left Great Yarmouth failed to avenge the loss of the flying-boat, for all the pilots who left the air station flew to the eastward.

Although this action had had such an unfortunate result for us, nevertheless, on the same day, land machines from No. 5 Group (Dover) shot down 4 of the enemy's Brandenburg seaplanes off the Flanders coast. Several others were shot down also during the week by land machines belonging to the same group, which helped to show that when the enemy's pilots were faced with machines of similar performance, the result was not always in the

62  
26  
23

POST CARD  
C. 1918



L. 70. Shot down in flames August 5, 1918, by Major Egbert Cadbury, D.S.C., D.F.C., and Captain Robert Leckie, D.S.O., D.S.C., D.F.C.

enemy's favour, as was the general case when the Brandenburg seaplanes attacked any of our float seaplanes.

On the occasion of the fourth anniversary of the War there were, including the night landing-grounds, 94 officers on the air station, all under the command of Lieutenant-Colonel Vincent Nicholl, D.S.O., D.S.C. The following officers had joined the station from other units since April (in addition to those mentioned in the text in connexion with some particular action): Captains C. H. James, C. D. Kirkpatrick, R. Sorley, C. B. Sproat, and Lieutenants H. C. Armitt, B. E. Barwell, C. F. Snowden Gamble, R. W. A. Ivermee, R. E. Keys, H. K. Prendergast, and G. W. Stallard.

July had been a successful month for the enemy's seaplanes, but with the coming of August the pendulum swung the other way, and during the first fortnight of the new month the enemy's naval air Service suffered two heavy losses.

The weather was bad for the first week of August, yet on the fifth day the enemy attempted, for the last time during the War, to raid this country with Zeppelin airships. Only three such raids had been made previously during this year.<sup>1</sup>

The raid of August 5/6 was made by 5 Zeppelin airships: *L. 70* (Kapitänleutnant von Lossnitzer), *L. 65* (Kapitänleutnant Walter Dose), *L. 63* (Kapitänleutnant von Freudenreich), *L. 56* (Kapitänleutnant Stelling), and *L. 53* (Korvettenkapitän Proelss). Of these airships *L. 70*, *L. 56*, and *L. 53* were stationed at Nordholz, *L. 65* at Tondern, and *L. 63* at Ahlhorn, and it was from their respective stations that they left to make this raid.

This raid was of importance for, amongst other things, it was led in person by Fregattenkapitän Peter Strasser aboard *L. 70*. It was also the first (and only) occasion in which the new *L. 70* class took part in a raid.

Over the east coast of this country the weather was good,<sup>2</sup> the sea was smooth, but over the land there was much local mist and rain, and the barometric pressure was lower than in the case of any other previous raid by airships.

The enemy have stated since that their objective, in this case, was 'the Midland areas'. The various airships left their sheds

<sup>1</sup> March 12, over East Riding, Hull; March 13, over West Hartlepool; April 12/13, over Lincolnshire, Northamptonshire, Lancashire, Warwickshire, and Norfolk. Vide *The German Air Raids on Great Britain, 1914-1918*, pp. 190-9.

<sup>2</sup> Until a height of 2,200 feet was reached, when rain and clouds drifting in from the west hid the ground for about 2,000 feet.

about 3.30 p.m., and about 8.0 p.m. three of them were sighted from the Leman Bank light vessel (about 35 miles north-east of Great Yarmouth) proceeding on parallel courses, but a few minutes later they were seen to deploy into Vee-formation. This information was transmitted to the commodore-in-charge, Lowestoft, who informed Captain Leckie (who was 'Deputy Commanding Officer') 'at 2050 hours . . . to the effect that 3 Zeppelins had been sighted over Leman Bank light vessel, steering west'. Leckie telephoned immediately for Lieutenant-Colonel Nicholl and Major Cadbury—who were both in the town—to come at once to the air station. He ordered also all available machines to be prepared for action, and gave similar orders to the Burgh Castle and Covehithe stations. Within 20 minutes of the receipt of this information officers and men had been collected from various messes and houses in the town, and 7 machines were in the air and flying towards the approaching enemy. Fifteen minutes after this 13 machines were in the air belonging to Great Yarmouth, Burgh Castle, and Covehithe air stations.

One of the machines that left Great Yarmouth that night (and, moreover, within a quarter of an hour of the first news of the presence of the enemy) was a D.H. 4 piloted by Major Cadbury with Captain Leckie in the back seat, and it was these two officers who were responsible for inflicting great loss on the enemy that night. At the time the news of the approaching enemy was brought to the air station Cadbury was at a concert. What happened immediately afterwards is best told in his own words:

' . . . was singing at a concert across the road in aid of some charity and singing very well, too. I was enjoying the music, and war and rumours of war were far from my thoughts. . . . a cousin of . . . staying with us and I were enjoying a particularly fine piece of music when a cross-eyed R.A.F. orderly struck me with his converging vision.

' I guessed I was wanted and hastened to join him. He informed me that Nicholl wanted me at H.Q. I dashed along the front, and, to my intense surprise, saw an airship in the dim distance, silhouetted against an extremely bright, clear, northerly, evening light. That was about 8.45 p.m.

' I learnt at H.Q. that 3 Zeppelins were at a point about 50 miles north-east of here, well to seaward. Knowing that there was only one machine available that had the necessary speed and climb—its twin having already gone—I saw that the race was to the nimblest, to the pilot who could get into the waiting seat.

' I roared down to the station in an ever-ready Ford, seized a scarf, goggles and helmet, tore off my streamline coat, and, semi-clothed, with a disreputable jacket under my arm, sprinted as hard as ever Nature would let

me, and took a running jump into the pilot's seat. I beat my most strenuous competitor<sup>1</sup> by one-fifth of a second. Once in that seat I knew, that, given a reasonable amount of luck, I should certainly destroy one, if not three of the intruders.

'I saw them as I left the aerodrome, and gave immediate chase. I released my bombs to lighten ship, but my machine did not climb as it should have done. I had as my observer "Bob" Leckie, D.S.O., D.S.C., who has had a good many scraps with Zeppelins and has destroyed one. Only, all his service has been with "Boats". Thus I had an expert in the back seat.'

Thereafter:

'Immediately on leaving Yarmouth, I sighted 3 Zeppelin airships to north-east, distant about 40 miles, steering west at a slow speed, and I gave chase.

'At approximately 2145<sup>2</sup> the Zeppelins, which were flying in Vee-formation, altered course north, at 2210 Zeppelin abeam 2,000 feet above us at 17,000 feet. At 2220 we had climbed to 16,400 feet and I attacked the Zeppelin ahead slightly to port so as to clear any obstruction that might be suspended from the airship. My observer trained his gun on the bow of the airship and the fire was seen to concentrate on a shot (explosive bullet) under the Zeppelin, three-quarters way aft.

'The "Z.P.T."<sup>3</sup> was seen to blow a great hole in the fabric and a fire started which quickly ran along the entire length of the Zeppelin. The Zeppelin raised her bows as if in an effort to escape, then plunged seaward, a blazing mass. The airship was completely consumed in about three-quarters of a minute. A large petrol tank was seen to become detached from the framework and fall blazing into a heavy layer of clouds at about 7,000 feet below.

'On seeing the fate of their companion, the remaining two Zeppelins immediately altered course east and proceeded in that direction at a high speed.'

The airship that he and Captain Leckie had destroyed was *L. 70*, the finest rigid airship in existence, and in her was Fregattenkapitän Peter Strasser. In a letter to his father (the late Mr. George Cadbury) his son remarked, apropos the destruction of *L. 70*, 'that another Zeppelin has gone to destruction, sent there by a perfectly peaceful "live-and-let-live" citizen, who has no lust for blood or fearful war spirit in his veins. It all happened very quickly and very terribly.'

The commander of *L. 63* was Kapitänleutnant von Freudenreich, and he has been good enough to contribute the following note on the destruction of *L. 70*:

'*L. 70* was on my port side, bearing about south-west, perhaps 20 miles off. My altitude was, if I remember well, about 5,800 metres,<sup>4</sup> the temperature

<sup>1</sup> Captain Sproat.

<sup>2</sup> This is the code time based on the 'twenty-four-hour clock'—in other words, 9.45 p.m. <sup>3</sup> Explosive bullet. <sup>4</sup> 17,800 feet.

28° Celsius. I was near the coast when we suddenly saw a huge flame on the *L. 70*. It looked like a huge sun. Then the whole ship was on fire, one could see the flames all over her. Then she stood up erect and went down like a burning shaft. The whole thing did not last more than 30–45 seconds. I knew it had been done by aeroplane, so I went up to 6,500 metres,<sup>1</sup> crossed the coast later on, and dropped my bombs on a battery which was firing at me.'

After *L. 70* had fallen in flames and, in Major Cadbury's words, 'the remaining two Zeppelins' had 'altered course east and proceeded in that direction at a high speed', Cadbury experienced trouble with the engine of his machine, for:

'At this moment my engine cut out completely, owing, I presume, to a temporary block in the petrol system. I managed to get my engine going again and closed with the second Zeppelin. I again attacked bow on, and my observer opened fire, within 500 feet of the airship. Fire immediately broke out in the amidships gondola. At this point my observer's gun jambed owing to a double feed, which, in the darkness, could not be cleared. The fire on the Zeppelin became extinguished. I maintained contact with Zeppelin for approximately 5 minutes while my observer attempted to clear the jamb but without success.<sup>2</sup> I was unable to use my front gun as I had reached my ceiling.'

This second airship which Cadbury attacked was *L. 65*, which was commanded by Kapitänleutnant Walter Dose, and this officer has kindly contributed the following notes on the part he and his airship played in this raid. He states that:

'I started with *L. 65* at 3.35 p.m., on August 5 from Nordholz. The journey was carried out under very favourable wind conditions and according to programme. *L. 65* was, at 7.30 p.m., 60 nautical miles from the English coast, together with *L. 53* and *L. 70*. We stayed here at an altitude of 5,000 metres<sup>3</sup> in order to wait until dark. We could see *L. 56* and *L. 63* clearly against the bright sky in the north. The temperature was very unfavourable for an attack, but, in spite of this, it was, in the end, possible to get the airship up to an altitude suitable for an attack.

'After dark, *L. 65* opened with an attack on King's Lynn, followed by *L. 70* and *L. 53*. Beneath the airships was a complete layer of clouds, through which *L. 65* was repeatedly hit between 11.0 and 11.15 p.m. At about 11.10 p.m.<sup>4</sup> *L. 70* was port astern about 3,000 metres<sup>5</sup> from *L. 65*.

<sup>1</sup> 21,300 feet.

<sup>2</sup> In his haste Captain Leckie had forgotten to take his gloves with him, and in consequence two of his fingers were very badly frost-bitten. The jamb was caused by a 'cross-feed', and in the pitch darkness and with his injured hand it was absolutely impossible for Leckie to clear the gun.

<sup>3</sup> 16,350 feet.

<sup>4</sup> This is German time.

<sup>5</sup> 3,300 yards.

'Suddenly we saw a small light on the otherwise quite dark ship which rapidly spread, and shortly afterwards the whole ship was in flames. She started to fall with running engines, first slowly, then faster and faster, and was broken to pieces shortly before she entered the above-mentioned cloud screen. We could not see if any of the crew jumped out in parachutes.'

'It must be regarded as correct that *L. 70* was brought down by aeroplanes, as *L. 65* (shortly after the burning of *L. 70*) was attacked by two enemy machines whose bullets effected several holes in her. Gas-bags 4, 5, 6, and 7 of *L. 65* showed numerous holes, in all 312, and they started to empty very quickly. For this reason all the bombs that were left were dropped on the batteries in the neighbourhood of King's Lynn<sup>1</sup> and retreat ordered.'

'From the English wireless we understood that the English side thought that in addition to *L. 70* also *L. 65* had been brought down.<sup>2</sup>

'On the return journey it was necessary to cut out two stern engines at 3.15 a.m. and 3.25 a.m. respectively, and to proceed with only three engines, because, with the loss of gas in the stern gas-bags, there was the danger of the airship breaking in the middle.'

'The ship arrived at Nordholz, the home station, on August 6, at 7.55 a.m.'

It will be remembered that both Major Cadbury and Captain Leckie believed that after the latter officer had opened fire on *L. 65* a 'fire immediately broke out in the amidships gondola'. Kapitänleutnant Walter Dose was approached subsequently by the author on this point, and he replied that:

'With reference to the opinion of Major Cadbury, that he set fire to the amidships gondola of *L. 65*, I beg to remark that this opinion is an error which can be cleared up as follows: The whole ship, especially the gondolas, was darkened by black curtains, while the gondolas were illuminated by electric light. During the attack, one of the motor-mates of the amidships gondola raised the black curtain, so that, for a moment only, the gondola was brightly enlightened. This event probably has induced Major Cadbury to believe that he set fire to the gondola.'

Kapitänleutnant Dose also paid a tribute to the skill of Major Cadbury and Captain Leckie, for 'they perforated four of the ballonets like sieves, so that the homeward journey was not a special pleasure'. As Captain Leckie was able to fire only a short burst at this airship before his machine-gun jambed, it is difficult to understand how *L. 65* received 312 bullet holes; the only possible explanation is that other machines must have fired at

<sup>1</sup> Actually they would appear to have fallen into the sea.

<sup>2</sup> This was due to the report of one of the pilots from the air station (Lieutenant R. E. Keys), who believed at the time that he had shot down another airship—of the Schütte-Lanz type—in flames. His claim, however, was not substantiated.

her, and, indeed, both Cadbury and Leckie were of the opinion that this damage was inflicted by Captain Jardine and Lieutenant Munday who were flying in a D.H. 9 below Cadbury's D.H. 4.

Nevertheless *L. 65* managed to get home, a feat which, as her commander generously states, 'was not only the merit of her captain, but also of her whole crew, who had always so eminently done their duty'.

After Cadbury's and Leckie's attack on this airship, which they had to break off owing to engine trouble, 'course was altered to the south-west and, after flying for 25 minutes at 100 miles per hour, and having passed through four layers of thick clouds, the lowest being about 5,000 feet, I sighted flares of a night landing-ground, and landed at 2305 at Sedgeford and reported to base'.

The day after this attack Cadbury wrote a private letter, and, describing his flight after the attack on *L. 70*, he said:

'My engine stopped. I was 30 to 40 miles from land, on what had become an awful night. But the Fates were kind, and after a few splutters and bangs I got her going. I attacked the second airship,<sup>1</sup> but here my luck was out. Leckie's gun jambed—our sting had gone. There was nothing for it but to abandon the chase. I was lost. I think that half-hour, driving through 12,000 feet of cloud in inky blackness on a machine that I had been told could not land at night, even if I ever made land again, was the most terrible I have ever experienced.'

'I made Sedgeford, and landed safely, missing another machine that was circling round the aerodrome by inches. It suddenly loomed up in the blackness.'

'To my horror I discovered that my bombs had failed to release, and that I had landed in a machine which I thought I was certain to crash and catch fire with two 100-lb. bombs on board; also, that my life-saving belt had been eaten through by acid from an accumulator.'

*L. 70* having been destroyed attention must be devoted to the activities of the 12 other machines. Between 9 and 10.0 p.m. 13 machines from Great Yarmouth and 26 from other stations were groping in the mist looking for the enemy. Although most of the pilots from Great Yarmouth saw the enemy airships only one or two came within range.

The pilots and observers of the land machines who arose (in addition to those already mentioned) were Captains C. B. Sproat and J. Hodson in a D.H. 4, Captain C. S. Iron, Lieutenant H. G. Owen, Captain B. G. Jardine, Lieutenant E. R. Munday, and Lieutenant H. K. Prendergast and Second Lieutenant E. Gray

<sup>1</sup> *L. 65.*

in D.H. 9's, while Captain C. D. Kirkpatrick and Lieutenant G. W. Stallard were in Camels.

Three pilots from Burgh Castle night landing-ground went up in Camels—the officer commanding, Captain Fane, and Lieutenants G. F. Hodson and Tompkins. The first of these officers described his experiences and his misfortunes as follows:

'About an hour before dusk, Yarmouth reported that hostile *aeroplanes* were approaching the town from the east. There were two Sopwith Camels out on the aerodrome, and my own Camel, which was fitted with a Lewis gun, was in the hangar. I jumped into the first one I was near and, with Lieutenant Hodson, we started off within two minutes of receiving the warning, leaving orders that all available pilots were to proceed into the air as soon as possible. We had not been in the air 5 minutes when I sighted, not *aeroplanes*, but three Zeppelins in broad daylight about 20 miles off. Imagine my thoughts with a machine with nothing except two Vickers guns and no anti-Zeppelin ammunition at all! However, I proceeded towards them, knowing that Hodson was all right with a Lewis gun and plenty of ammunition, and also a D.H. 4 from Yarmouth was not far behind me. I unfortunately found that an oil pipe had come unscrewed just where I could not reach it, so I was forced to return, and I landed at Yarmouth after dark to find that a Zeppelin had been shot down off Cromer by Cadbury. If *only* the telephone operator had said airships instead of aeroplanes, I should have gone in my own Camel and probably have been there about 10 minutes before Cadbury. Poor Hodson was never heard of again.'

It is believed that Lieutenant G. F. Hodson mistook the burning petrol from *L. 70* for landing flares and alighted on the water and was drowned, and a similar fate is believed to have overtaken Captain B. G. Jardine and his observer Lieutenant E. R. Munday. The latter's body was picked up a few days later at sea by a mine-sweeper, but no traces of Captain Jardine or the machine were ever found. Rumours were prevalent after the War that the enemy claimed to have shot a Camel down that night, but all the surviving commanders of the airships that took part in this raid have been approached by the author with regard to this claim, and they have no knowledge of it, although one German authority has stated that Lieutenant Hodson was shot down in flames from *L. 70*.

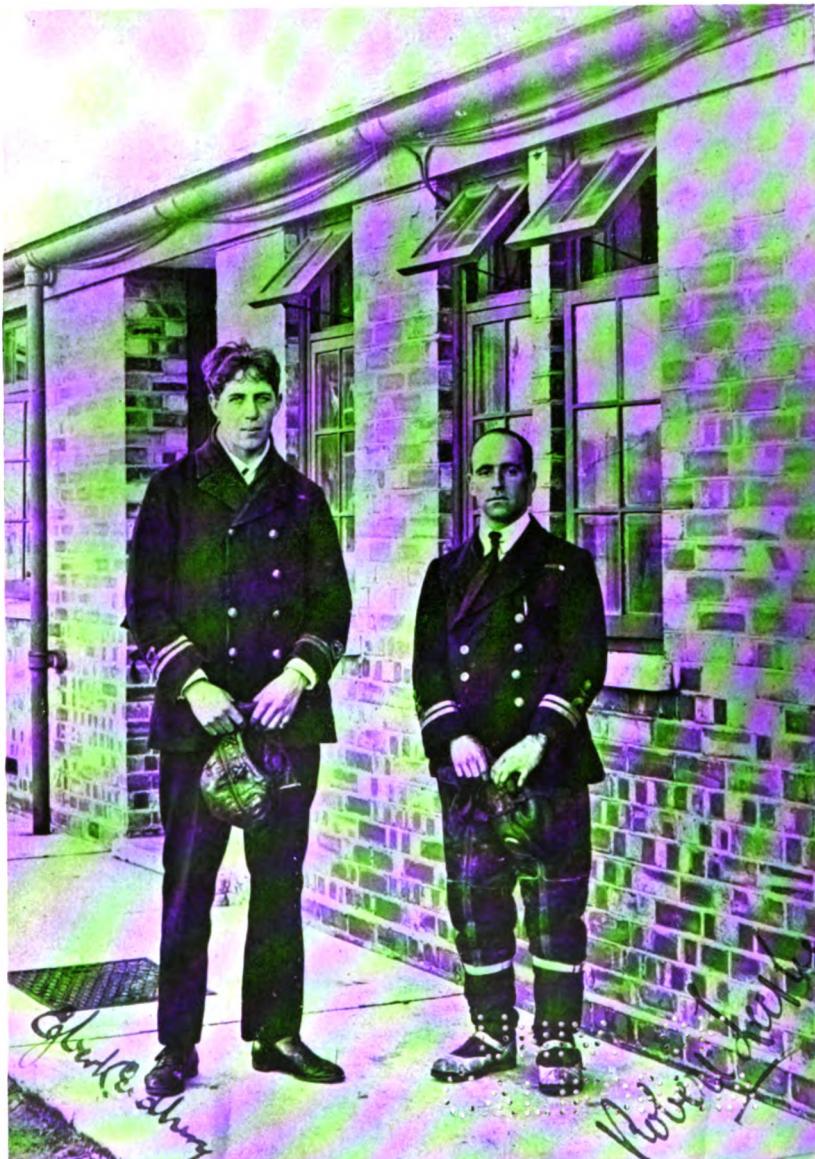
Two officers from Covehithe night landing-ground went up to the attack—Lieutenant W. R. Plaskett and Sergeant Kelling in a D.H. 4 and Lieutenant F. R. Bicknell and Sergeant Bull—but they did not succeed in engaging the enemy. The flying-boat *N. 4303* from Great Yarmouth with Captains Fetherston and Mossop on her also did not succeed in getting within range of the airships.

The raid was now over and, from the enemy's point of view, it must be adjudged as having been a failure, for not one single bomb was dropped on land, and the enemy lost their finest airship and the chief of their airship Service. *L. 70* fell in the sea a few miles from Wells-next-the-Sea (approximately  $53^{\circ} 1' N.$ ,  $1^{\circ} 4' E.$ ), and only one of her crew was ever found, namely, the second-in-command, Leutnant zur See von Kruger, whose body was picked up some time later by the enemy off the Frisian coast. Parts of the airship were washed ashore north of the Wash. It is interesting to remember that Strasser led the first airship raid on this country (January 19/20, 1915) and the last, and both times he passed over or near Great Yarmouth.

Peter Strasser was a very able and very gallant officer, and his fellow officers have one and all admitted that to him must be awarded the palm for having built up the Imperial German Airship Service, for, as Admiral Scheer has said, 'he was the life and soul of the whole'.

In addition to the loss of the three officers from Great Yarmouth mentioned already, an officer from No. 33 Squadron—Lieutenant F. A. Benitz—was killed through crashing in the dark at Atwick in a Bristol fighter, for, as well as the 13 machines that went up to the attack from Great Yarmouth air station and her attendant night landing-grounds, 20 other machines arose from air stations farther inland, but none of them sighted the enemy.

For their services that night Lieutenant-Colonel Vincent Nicholl D.S.O., D.S.C., informed the commodore at Lowestoft (Commodore A. A. Ellison, C.B., R.N.) that he considered 'that the following officers and airmen are worthy of award for the part they played in these operations, for their gallantry, skill, and devotion to duty: Major E. Cadbury, D.S.C., Captain R. Leckie, D.S.O., D.S.C., Lieutenant R. E. Keys, and Private A. T. Harman, Gunlayer O. N. 210675'. The commodore recommended to the responsible department that His Majesty the King be asked to grant the Victoria Cross to Major Cadbury for the very great courage he had displayed that night—courage shown, not only in attacking two airships, but in flying in a land machine with no flotation gear 30 to 40 miles out to sea in bad weather. The appeal was not granted by the authorities, but His Majesty the King was pleased to award subsequently the Distinguished Flying Cross to all three officers and the Distinguished Flying Medal to Private A. T. Harman.



Major Egbert Cadbury, D.S.C., D.F.C., and Captain Robert Leckie, D.S.O., D.S.C., D.F.C., photographed at Great Yarmouth air station a few hours after they had shot down *L. 70*.

NO. 111111  
AMERICAN

Five days later one of the airships that took part in this raid, *L. 53* (Korvettenkapitän Proelss), was shot down in flames by an officer from the air station, Lieutenant S. D. Culley, when flying in a Camel released from a lighter. Culley had gained previously considerable experience in flying off the deck of the aircraft-carrier *Nairana* at Rosyth, and it was he who had sought and obtained approval at the end of July to make the second experiment to fly off from a lighter, the first having been made on May 30 by Lieutenant-Colonel Samson in a Camel.

As a result of the success that Culley achieved on this occasion it was decided to see whether or not this device, which enabled our aircraft to be available nearer to the probable zone of the operations of the enemy airships, would render more efficient our protective measures. If we could maintain our offensive patrols, the machines being able to take the air at once directly an airship was sighted, there was a much greater chance of an action being effective than if one pilot were called for duty by signal to an air station, however near to the coast that station might be. Moreover, the Harwich Force was being hampered continually in its operations by the presence of patrolling Zeppelin airships which, at heights in the neighbourhood of 20,000 feet, were immune from naval anti-aircraft fire and from the attention of flying-boats. It was decided, therefore, to attempt operations in another way at an early date.

Accordingly, on the evening of the 10th (August) the Harwich Light Cruiser Force put to sea to conduct some special operations in Helgoland Bight. Accompanying the force was the destroyer *Redoubt*, which was towing a lighter, carrying a Camel with Lieutenant Culley as her pilot. Three flying-boats from Great Yarmouth accompanied the flotilla also, together with three flying-boats from Felixstowe to act as decoys, but the latter were aboard lighters.

The light cruisers were carrying also six coastal motor-boats (C.M.B.'s), for the main object of the whole operation was that these boats, after they had been placed in the sea by the light cruisers on whose decks they were carried, should proceed at a high speed into the Bight and torpedo any enemy craft they sighted. The flotilla and accompanying aircraft were under the command of Vice-Admiral Sir Reginald Tyrwhitt, D.S.O., who was flying his flag in the *Curaçoa*.

At 5.30 a.m. the cruisers hove-to off Terschelling, and half an hour later the six coastal motor-boats were hoisted out from their

cruisers (there were two in each) and placed in the water. Their engines were started up, and in line-ahead, in a calm sea except for a long swell, they started for the mouth of the River Ems. At the same time that they left for the German coast the three flying-boats from Felixstowe were slipped from their lighters, but the pilots could not get them off the water owing to the long smooth swell, the absence of wind, and a heavy overload of petrol and ammunition, so that all three machines had to be taken up on the lighters again: this was the first breakdown of the day's operations. A few minutes later the three flying-boats from Great Yarmouth 'boomed up' under the command of Major Leckie. What happened next is best told in the words which he recorded privately a few days later:

'Upon arrival over the Harwich Force, I received the following order by visual signal—"Proceed in direction of Terschelling, seek for 6 C.M.B.'s now overdue." I had not known until that moment that C.M.B.'s were being employed. In accordance with orders, I proceeded, and when nearing Terschelling, Fetherston, in one of the other boats, commenced to signal to me—"Zepp—". As soon as the first word of his message was received, attention was directed skyward and to the north-east, and sure enough, a Zeppelin was seen approaching at a height of about 15,000 feet. Now, I was aware that Culley and his Camel were with the flotilla, and I had no intention of spoiling his show by commencing an attack on the Zeppelin which would be certain to prove abortive, and, as I could not break W/T silence, I turned back and, upon reaching the flagship, reported by visual signal as follows—"Zeppelin NE. of flotilla, steering W." Whereupon I received the signal—"Do not interfere, Camel is going off"<sup>1</sup>—followed by the astonishing order—"Return to your base". In accordance with these orders, course was set for Yarmouth.'

At the time Major Leckie was very surprised to receive the last signal, especially as his patrol had just started. It transpired afterwards that the signal was sent in error.

*L. 53* was sighted just before 8.30 a.m. at a great height away to the north-east, and so—according to German official accounts—was the Harwich Force by 'a torpedo fighting squadron', who sent out a 'general warning to all the air stations in the Bight'.

Admiral Tyrwhitt then ordered his force to turn away 16 points with the object of enticing the Zeppelin airship seawards. This manœuvre, combined with the use of smoke screens, seemed to

<sup>1</sup> Earlier in the morning Admiral Tyrwhitt had been informed by the Admiralty that *L. 53* was in the vicinity.

have aroused the curiosity of Korvettenkapitän Proelss, for he followed in the wake of the cruisers and destroyers.

Lieutenant Culley, acting on instructions, left the deck of the lighter (after his machine had run along only 5 feet of it) at 8.58 a.m., and started to climb towards *L. 53* with the sun behind him. At about 9.30 a.m. *L. 53* was at a height of 19,000 feet and the Camel 1,000 feet lower. Exactly one hour after he had left the deck of the lighter Lieutenant Culley was 200 feet lower than *L. 53*, and they were heading straight for each other, but he could feel that he was nearly at the ceiling of his machine, for she would not answer her controls. He then pulled back his control stick, stalled his machine, and opened fire (the Camel was armed with two Lewis guns)—one gun jambed after firing 15 rounds, but the other continued firing until it stopped for lack of ammunition—but although he could see the bullets striking the airship, she did not appear to catch fire. He then dived away to the right and, looking over his shoulder a few seconds later, saw little bursts of flame on the envelope of the airship. A few minutes afterwards she was burning furiously and sinking by the head; the bow then broke away, and, standing vertically upwards, she plunged seawards in a blazing mass. She burnt out long before she reached the water, and Lieutenant Culley stated that from the position in which he viewed her the smoke was blown into the shape of a huge question-mark. He saw one of the crew jump from her (a distance of nearly three and a half miles), his clothes alight, but, extraordinary as it may seem, this man was picked up later, practically uninjured, by a Dutch fishing vessel.

*L. 53* was destroyed at 9.58 a.m., and fell into the sea at a position approximately 10 miles south-west of Borkum Riff light vessel. Culley's own report of the action ran: '8.58, flew from lighter to attack Zeppelin in sight to eastward. Rose to 18,700. Attacked Zeppelin from 300 feet below. Fired 7 rounds from No. 1 gun, which jammed, and a double charge from No. 2. Zeppelin burst into flames and was destroyed.'

After he had seen her fall in flames Culley, in the words of one of his fellow officers,

'flew straight to the Dutch coast, went south until he arrived at the Texel, and then went out to the rendezvous at Terschelling Bank. Here, at 6,000 feet, there were patchy clouds between him and the water, and he could see no destroyers.'

'His pressure petrol tank ran out.'

'He switched over to the emergency gravity tank. It contained only

enough petrol for 20 minutes, not nearly enough for him to get safely back to the Dutch coast.

'Looking down, he saw a providential Dutch fishing-boat and decided to land beside it. As he dived down he saw two destroyers come out from under the edge of a cloud. And then he saw the whole flotilla. Looping and rolling over the fleet to relieve his pent-up feelings, he picked up his destroyer with the lighter, fired a light as a signal, and landed in front of her. He was picked up, the Camel was hoisted on the lighter, and the flotilla started back for Harwich.'<sup>1</sup>

Culley recorded this part of his experiences that day as follows: 'Returned to squadron and landed in the water with one pint of petrol in tank.'

Lieutenant S. D. Culley was recommended for the Victoria Cross in recognition of the bravery he had shown this day, but the award was not approved. Later, His Majesty the King appointed him a Companion of the Most Honourable Distinguished Service Order for the services he rendered during this attack.

A German officer has kindly contributed the following notes on these operations:

'Early on August 11, at 7.24 a.m., a torpedo fighting flight sighted and reported near Terschelling Bank four enemy ships with eight destroyers with one machine each, apparently Curtiss flying-boats in tow. With these were six coastal motor-boats going full speed on an east-south-easterly course. Reinforcements were thereupon summoned from all air stations. The Borkum fighting squadron met six coastal motor-boats between Terschelling and Ameland going east at full speed.

'After dropping bombs under heavy machine-gun fire the boats turned round and were now attacked at close quarters with machine-gun fire. Meanwhile, the Norderney fighting squadron arrived also and took part in the fight. Two coastal motor-boats were chased by well-directed fire on to Terschelling beach and they then caught fire. A machine of the Norderney fighting squadron set a boat on fire by dropping bombs on her, but came down in flames itself. The three remaining coastal motor-boats lay stopped, smoking and burning, two without crews, and the third, with a crew from another boat, waving a white flag.

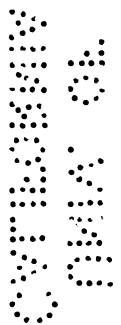
'After the fight the squadrons saw a Zeppelin (L. 53) at a great height. This suddenly burst into flames and fell burning and broke in halves. Two English flying-boats were sighted in the distance.'

As this German account states correctly, the attack by the coastal motor-boats was a complete fiasco, for they failed to torpedo any enemy craft and were themselves destroyed when off the Dutch coast by seaplanes from the stations at Borkum and

<sup>1</sup> *The Spider Web*, pp. 238-9.



L. 53. Shot down in flames by Captain S. D. Culley, D.S.O., August 11, 1918.



Norderney.<sup>1</sup> The action is historic in that, during it, aircraft inflicted a greater loss on sea-going craft than at any time during the War.

During one of the incidental discussions held between the naval and Royal Air Force officers concerned, while they were planning the whole operation, the flying-boat pilots from Great Yarmouth and Felixstowe were unanimous in their opinions that if the coastal motor-boats were allowed to operate off the Frisian coast unescorted by Camels, then the former craft would be all destroyed by Brandenburg monoplanes. Unfortunately, this warning was not heeded, and the tragic result of disregarding it was but another illustration of the penalties incurred by lack of co-operation between sea- and air-borne craft and between those who control their movements.

There is a certain irony in the fact that while officers from Great Yarmouth had been shooting down enemy airships, others on the air station had been engaged in helping to perfect a device which, it was hoped, would prevent our own rigid airships from being destroyed in a similar way. In the summer of this year it was decided to proceed with experiments with a view to discovering a suitable means of providing an aerial escort to our own rigid airships, the said escort to take the form of a single-seater fighter which the airship was to carry with her while in flight. The airship selected for the initial trials was H.M.A. *R. 33*. The design of the fittings for attaching and disconnecting the machine to and from the airship, in so far as they affected the aeroplane, was constructed by some of the personnel of No. 212 Squadron (Great Yarmouth air station).

In the first experiment *R. 33* ascended with a Camel (containing a dummy pilot) slung from the underside of the airship's envelope. When *R. 33* was in the air the Camel was released from her supports, with the result that she glided to the ground. Having proved that the slipping gear functioned satisfactorily, Lieutenant R. E. Keys, D.F.C. (of No. 212 Squadron), was taken up in another Camel and released. He had no difficulty in starting his engine after his release, and flew around *R. 33*, landing perfectly safely afterwards at Pulham airship station, having performed a very brave act. It was not until after the War that

<sup>1</sup> For a description of this action as viewed from the coastal motor-boats vide an article written by one of their officers, Cedric Outhwaite, in *Blackwood's Magazine* of November 1927, entitled 'The Sea and the Air'.

the far more difficult experiment was performed of releasing and re-attaching a machine to an airship while the latter at the time was in the air and in motion. Officers of the Imperial German Airship Service have stated since that a machine was launched successfully from *L. 35* in 1917.

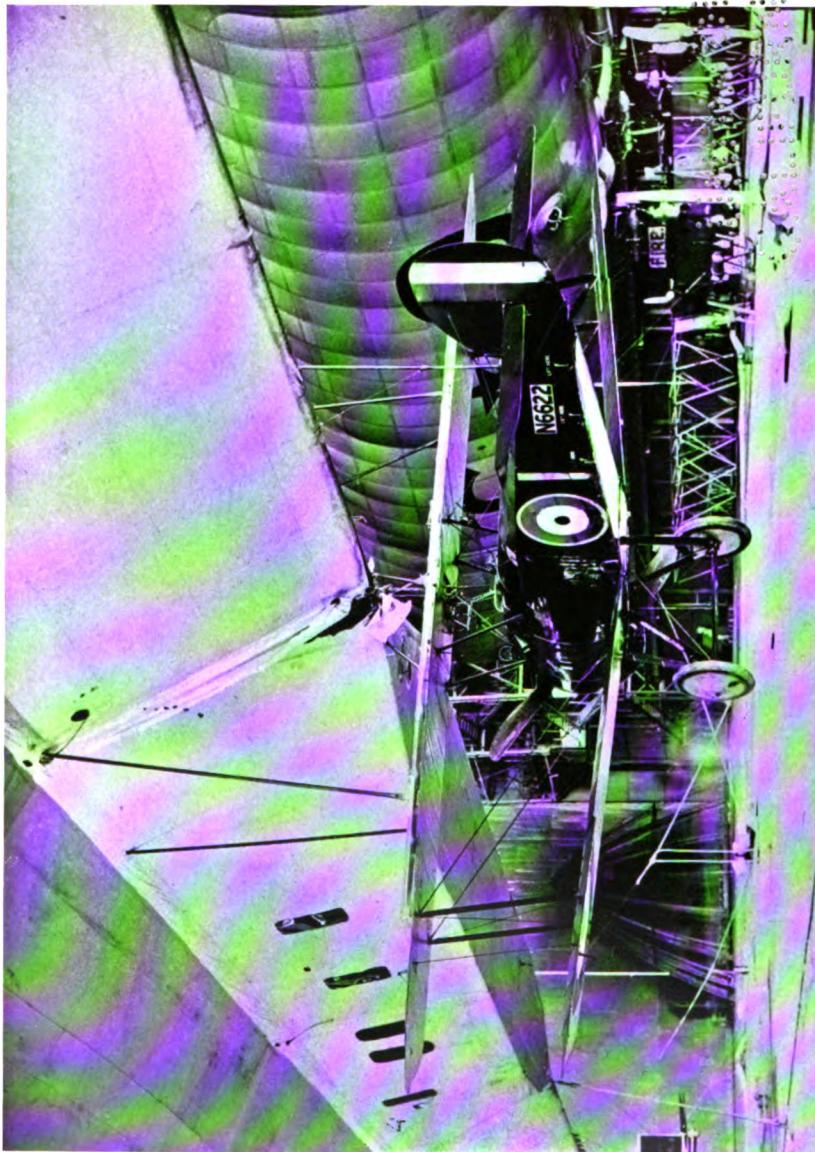
One of the most interesting events that happened during August connected with the air station was the taking over, on the 18th (under the Provisions of the Defence of the Realm Act), of Hickling Broad as an emergency alighting ground for seaplanes and flying-boats. During 1913 this site had been suggested (it may be remembered) as an alternative to Great Yarmouth as an air station, but nothing came of the proposal. During the War the Broad was used occasionally by machines. It is a matter for regret that it did not meet with more extended use, for, despite its shallowness, it would have enabled machines to leave and alight in safety when flight would not have been practicable owing to conditions in the Roads. Nevertheless, even after the water was taken over, it was used but rarely.

September brought with it the worst weather of the year, for there was no flying at all for exactly half the days of the month from the air station, the usual entry in the Daily Reports being, 'easterly gale blowing and no flying'. On the 16th, however, machines from the air station fought their last engagement with the enemy. Two flying-boats, *N. 4550* (Captain J. Hodson) and *N. 4549* (Lieutenant V. S. Green), and a D.H. 9 left the air station and flew down the coast and were joined off Covehithe by a D.H. 4 from that station. Captain Hodson has told what happened afterwards:

'The idea of patrol was to go down south about 40 miles out, pick up any enemy machines from Zeebrugge (if out), steer in towards the shipping Channel, luring the enemy on, and then send by wireless the mystic letters "M.M.", which signal was supposed to bring all the land machines from Dover to the Humber and to wipe up the enemy. Actually, we were accompanied by five D.H. 4's when we started, but by the time we had made Shipwash light vessel four of these had left—they had engine trouble, but this developed one by one, and so, what with escorting them each time to the coast, and doing other odd jobs which turned up, we were rather late at Shipwash. The remaining D.H. 4 was still with us, very high up and on the inside. We then steered east and duly picked up 5 hostile seaplanes about quarter of an hour later—we were then 3,000 feet and they were very low down but immediately underneath. I altered course south-west and Gibbs<sup>1</sup> wirelessed according to plan. The D.H. 4 met us, but I rather think

<sup>1</sup> The W/T operator in the flying-boat.

SOPWITH CAMEL SLUNG UNDER H.M.A. R. 33.



Digitized by Google

he failed to spot the enemy; I was too much engaged with the boat at the time, as her engine was badly losing revs., and I had to alter course again more to the east, eventually alighting near Shipwash. It turned out later that the petrol pipe of N. 4550 had been choked by a small piece of rubber piping between the top plane gravity tank and the carburettor. Just before alighting the enemy broke off, the hosts of land machines had not turned up, so why stay?'

Lieutenant Green claimed to have shot one of the enemy down, for it was seen to be on fire and was thought to have been destroyed. The rest of the German machines then turned to the east and, aided by their superior speed, escaped.

By the end of September the enemy started to make preparations to evacuate the Belgian coast and, as stated already, the action of the 16th was the last one fought by pilots from Great Yarmouth air station, and it is thought, therefore, that it may be of interest to give some account of a typical day's work on the air station at this period.

It is difficult to describe such a day, for the work done varied according to the weather, particularly where the activity of a station like Great Yarmouth was dependent entirely for its daily programme on the state of the sea. In France, on the other hand, patrols and bombing raids had to be performed almost without regard to the weather. At Great Yarmouth, however, if the sea were very rough all seaplane flying was stopped automatically, and, as a great many of the patrols performed by the land machines were in the nature of an escort to the seaplanes and flying-boats, the activity of these escorting aeroplanes was, in some measure, dependent upon the ability of the seaplanes to brave the weather and the sea. It is desirable, therefore, to take two days—a fair and a stormy day—if it be desired to describe the normal activities of 'the daily round and common task'.

The following description of the work done on two such days has been contributed by an officer<sup>1</sup> who was formerly of the air station:

'During the late part of 1918 the following was the general position of affairs. First of all, let it be remembered that the officers' and men's quarters at the air station were built only to accommodate a nucleus or emergency crew—consisting of about 10 officers and 200 men, as against a total complement of about 80 officers and 900 men. The remaining officers were quartered at the "Royal Hotel" and in scattered hostellries throughout the town. The men had the C.D.S., or the old Coastguard Station, and adjacent hotels, such as the "Imperial", as their sleeping-quarters.

<sup>1</sup> Major Cadbury, D.S.C., D.F.C.

'The C.O. and First Lieutenant, apart from their emergency cabins at the air station, made the "Royal" their main head-quarters. At the station, therefore, it was necessary to ensure that there was always a Senior Officer on duty, together with a sufficient staff to cope with any sudden emergency and to carry on until the whole staff could be mobilized at the station from the various living-quarters in the town.

'There was always on duty at the station the "Officer of the Day"—a Squadron Commander, who was responsible for seeing that the daily routine was carried out—that is to say, he was to see that all the patrols were off to time, to follow their progress for their wireless messages, see that all necessary signals were made and answered; in fact, for the 24 hours he was on duty, the life of the station was centred around him. Naturally, he had various Flight Commanders, seaplane and aeroplane pilots to assist him and to carry out his instructions.

'Let us now take a typical 24 hours' spell of fine weather. Those on duty at the air station used to work 24 hours from 9.0 a.m. one day until 9.0 a.m. the following day. Although an officer was not "Duty Officer" it did not mean that he was not on duty. During fine days and nights all officers were generally "standing-by", and as for the aeroplane flights, sometimes doing continuous flying.

'At 9.0 a.m., however, 24 hours' responsibility commenced for the Squadron Commander on duty. If flying permitted, a general parade of the whole air station took place, but as this was infrequent, it will be better to take dawn as the zero hour of our description.

'At about an hour before dawn the necessary machines required for the dawn patrol would be wheeled out from their sheds on to the Denes, the seaplanes on to the concrete—both classes of machines emerging into that peculiarly still, cold, and damp atmosphere that usually precedes a fine day, the stillness only broken by the slight hiss of the surf on the beach and the crowing of cocks. During the War, my most vivid impression in that dread hour before dawn was of the extraordinary persistence of the cock and its kind.

'Soon, however, its supremacy was to be challenged, for, after the ghost-like group of men had deposited their charges in their appointed places, a few spasmodic splutters would suddenly burst out into a roar, as a dozen Rolls Royce or Sunbeam engines started up—warming up for their task. Pilots and mechanics detailed for patrol would be hastily snatching an early breakfast—for, whatever was the result of their patrol, the soonest they could be back would be after 4 hours or more—sometimes 7 hours for the boats—and therefore it was highly desirable to be sure of at least a small meal.

'This dawn patrol was the most responsible and anxious duty that the Squadron Commander had to perform, for, apart from making certain that the flying-boats, seaplanes, and aeroplanes left at their right time, he had to decide if the weather was good enough for the combined seaplane and land machine patrols to be carried out. Dawn on the east coast (as I suppose anywhere at sea) is a treacherous time. So many times have apparently per-

fect dawns been the precursor of fog or rough weather. If a fog blew up, as it so frequently did, the land machines, when they returned, could probably land inland—but what of the seaplanes? If rough weather sprang up, and the North Sea whipped into a choppy sea, what was to happen if the aeroplane suffered from engine failure and crashed into the sea? Would the seaplane pilot be able to land safely and rescue his stricken brother, and, having landed, be able to take off again? On the other hand, risks must be taken, and if there was any doubt the patrol must go, as the War naturally demanded that risks must be taken. Imagine, therefore, the tragedy enacted on such occasions. To take an actual case, a Squadron Commander sent away in an aeroplane his best friend when there was an element of doubt—engine failure—the escorting seaplane unable to land close enough to the wrecked aeroplane—and machine and pilot lost—surely Fate could not be more cruel?

'However, the weather promising to be fair, away would go the seaplanes and the land machines, dawn would break, and out of the oily sea the sun would suddenly emerge. From now on until about an hour after sunset the station would be a scene of great activity, patrols leaving in all directions hourly, and those returning would land their pilots, dash off to make their reports—for, remember, a report that nothing had been seen was often just as important as if the German High Sea Fleet had been encountered. The machine would be taken in hand at once, the engineers would inspect the engine, cleaners wash off the machine, and the working party refill with oil and petrol, so that it should be ready to go off again at a moment's notice. So the day would progress until dusk fell—but after a particularly hectic day it was remarkable how frequently a strenuous night followed. At about 10.0 p.m. the Haisborough light vessel would report hearing sounds of aircraft engines overhead—soon to be followed by a message to say that 2 or 3 enemy airships were sighted steering west. The station once again became a scene of great excitement and activity. The night-flying machines would be rushed out, their engines warmed up, and, as soon as possible, away into the inky blackness would go half a dozen aeroplanes—the pilots having as their guide in getting off a small torch lamp held by an air mechanic at the far end of the Denes. Perhaps the report had proved to be incorrect—but the machines, once being off, in all probability they would fly up the coast to Sandringham and back once or twice and, having been in the air for 3 or 4 hours, would eventually land, sometimes only just in time to be prepared for the usual dawn patrol.

'Such was the routine of a fine day.

'Rough weather was a source of great joy for Great Yarmouth air station. There are many who were there who will never fail to give a sigh of relief when they hear a gale whistling through the tree-tops. After a succession of fine days and nights there was not a more comforting sound than a really first-class, sand-shifting north-easter! All this is provided that you were not on duty, for a gale was a troublesome matter at the air station. "A", "B", "C", and "D" sheds were always a cause of intense anxiety. "A" and "B"

sheds had roller shutters which slid down movable guides. When machines were wanted from their sheds, the shutters would be pushed up, the guides removed, and thus an opening made. "C" and "D" sheds had collapsible shutters which folded back from the centre to the two sides.

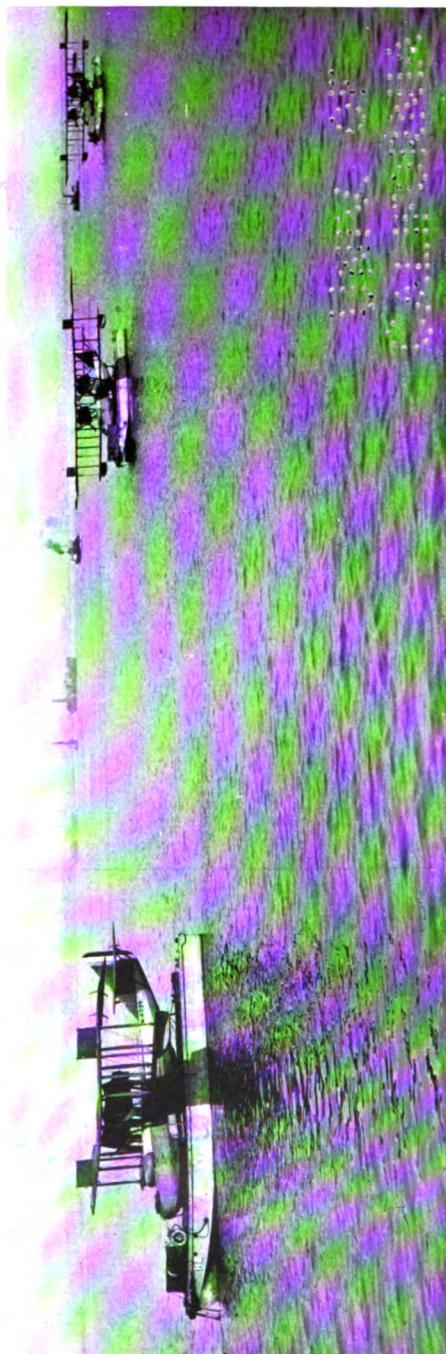
"A gale always spelt trouble, for the guides in "A" and "B" sheds would shift from their sockets and let loose the roller blinds which would flap inwards and smash the machine it came in contact with: the doors on "C" and "D" sheds would start folding on their own, and the machines inside, being exposed to the full blast of a merciless easterly gale, would seek comfort from each other by huddling together in a heap in one corner.

'Not only would the Duty Officer have to face this trouble and contemplate what the various Flight Commanders would have to say to him the next day about their damaged machines, but also he would generally have a flying-boat riding at anchor in the harbour—the sea having got up so quickly that it had been impossible to get the boat out to the slipway.

'Therefore, having had days and nights of ceaseless flying, his cup would be filled with a spell of bad weather!'

On October 24 an attempt was made to destroy the machines and the station at Borkum, but unfortunately the plan failed. The operation, as arranged, was intended as a combined one between the Harwich Light Cruiser Force and flying-boats from Great Yarmouth and Felixstowe air stations. It was decided that the Harwich Fleet should rendezvous off the Terschelling light vessel on the morning of the 24th towing three F.2a machines and four Camels on lighters. Great Yarmouth and Felixstowe were each to provide an aerial escort of five flying-boats.

The plan of operations was that at 5.30 a.m. that morning one of the light cruisers was to transmit by wireless telegraphy mock distress signals, in the hope that machines would be sent out from Borkum to investigate the matter. An hour later the three flying-boats in the lighters were to be released from their lighters and to proceed to the eastern end of Terschelling to act as a decoy in order to draw enemy machines over the Harwich Fleet. At 7.0 a.m. the flying-boats from Great Yarmouth were to leave the Roads and, when arriving, at about 9.0 a.m., over the fleet, were to go to the support of the Felixstowe machines if they were attacked, otherwise they were to fly to the eastern end of Ameland, stay there for an hour (that is, in a position 30 miles to the west of Borkum), and if attacked were to proceed to the west of Ameland, and there link up with the Felixstowe machines. All the flying-boats were then to give way slowly and retire on the fleet. When this occurred the Camels were to leave their lighters and fall upon the enemy from the rear.



FLYING-BOATS ABOARD TOWING-LIGHTERS.



The whole plan miscarried, for the fleet met exceptionally heavy weather: the Camels were smashed to pieces by the heavy seas, the flying-boats in the lighters could not be launched on account of the weather, and those from Felixstowe had to turn back on account of fog. The machines from Great Yarmouth won through, however, and sighted two enemy machines which had come out in answer to the mock distress signal, but were unable to engage them. After having patrolled for their allotted time the Great Yarmouth machines were ordered to retire home, and a few moments later 27 enemy machines bombed the fleet, which retired afterwards to Harwich.

The main event of October of domestic interest to the air station was the advent of a new commanding officer, for Lieutenant-Colonel Vincent Nicholl, D.S.O., D.S.C., was appointed to the command of an inland station. This very fine officer is now, unhappily, dead, and on his death an informed critic (who knew him intimately) said of him:

'His period of command at Yarmouth was worthy of an epic poem. . . . Among these men, Vincent Nicholl, the Commanding Officer, stands out by reason of his gift of command and leadership as much as by his personal bravery—and, be it remembered, ability to command, leadership, and individual gallantry are three quite different qualities which seldom meet in one person.

'In all these activities Vincent Nicholl was recognized by his officers and men as first among the first as a pilot and a fighting man. And on the ground they swore by him as the finest possible commanding officer.'

This tribute ended up with the following remark (and it is felt that no man could hope for a finer epitaph): 'Ask anybody who served at, or knew, Yarmouth under Vincent Nicholl's command, and you will get a picture of an air station as it should be in time of war.'

It was, and is, the hope of those who served under him that they were worthy of the privilege.

He was succeeded by Lieutenant-Colonel Ennis T. R. Chambers (and Commander R.N.), one of the earliest of the naval pilots, who had had a distinguished career in the Service. Under his command the station carried on unceasingly with its patrols, but with the evacuation of the Belgian coast the result of virtually all these patrols was 'nothing to report'.

With the coming of November it was realized that the end of hostilities was in sight: Germany was deserted by her allies, Turkey had fallen, revolution broke out in Vienna and Buda-

pest; but still the 'majestic war machine' seemed to obey 'the levers of authority', but soon strange hands were to handle those levers. It all came (like another occurrence) 'very quickly and very terribly': an armistice was signed on the 3rd between Austria-Hungary and the Entente Powers, mutiny broke out on the same day in the High Sea Fleet at Kiel,<sup>1</sup> on the 7th Bavaria proclaimed a Republic, on the 8th the German Delegates for an armistice arrived at the Allied General Head-quarters, the day after revolution broke out in Berlin, on the 10th the Kaiser abdicated and fled to Holland, and on the 11th hour of the next day hostilities ceased.<sup>2</sup>

It seems rather an anti-climax, after such tremendous happenings, to descend to the affairs of such a microcosm as Great Yarmouth air station, but it was the work of a multitude of such small units that brought about the Armistice—this is at once a truism and an excuse for continuing the story.

Right up to the last hour officers and men were carrying on with their work at the air station. As the hour of eleven approached all were conscious of a curious feeling—gladness that all the slaughter and tragedy were soon to be over—but still 'faced with the fear of the unknown'. War had become a part of the lives of all—something recognized—but now? No one knew.

On the stroke of eleven many enthusiastic people rang bells, fired rockets, and tried 'to be merry over the Armistice, but somehow, we have all got into such a groove that it is very difficult to realize how much it really means'. Amidst all this feeling (strange as it may seem, perhaps, to some) was a sort of sneaking pity for the enemy who had fought the War in the air in the North Sea so cleanly and so gallantly.

At such crises the trivial is apt to obtrude itself on the con-

<sup>1</sup> On October 28 the High Sea Fleet had been ordered to put to sea to engage the Grand Fleet, but the lesson of Jutland had been impressed deeply on the minds of the crews and they refused to sail.

<sup>2</sup> In the few weeks preceding the Armistice a large number of officers joined the station, and amongst these may be mentioned: Major Humphrey, Captains P. K. Fowler, L. C. Keeble, A. H. Sole, F. J. Vincent; Lieutenants G. B. Anderton, W. H. Bicknell, G. F. H. Bloom, H. A. Brosse, G. R. Burge, F. Burton, W. N. Cumming, H. P. Guard, A. MacFarlane, K. B. Preston, and L. W. Wilson; Second Lieutenants O. D. Bell, L. L. Bridgman, F. Eppinger, R. H. Galloway, H. G. Harris, M. J. Hennessey, R. N. Hesketh, L. W. Kidd, C. P. King, C. W. B. Llewellyn, C. Martin, T. W. Oliver, C. H. Smith, and R. N. Walter.

sciousness, and perhaps the one thing that many of those who were on the air station will remember was the fact that when the Mess sat down to lunch that day the Mess Cook—*mirabile dictu*—served brand-new *white* bread—the War was indeed over!

The Armistice terms were very severe, for they:

‘provided for the occupation by the Allied armies of all the territory west of the Rhine with three bridgeheads over that river at Cologne, Coblenz, and Mainz; for the handing over of large quantities of arms, equipment, material, and rolling stock; for the release of all Allied prisoners, and for the evacuation of all territory in the east occupied by German troops; for the annulment of the Bucharest and Brest Litovsk treaties, and for the surrender of all enemy submarines and a number of other ships of war.’<sup>1</sup>

The enemy were required also to surrender large quantities of aircraft and their components, together with certain airships.

The first contingent of the German submarines came over on November 20 to surrender at Harwich. They were met early that morning by Vice-Admiral Sir R. Tyrwhitt and the Harwich Light Cruiser Force at a rendezvous off the Cork light vessel. The officers and crews of three flying-boats from the air station were privileged to witness this historic event, and one of their pilots recorded subsequently his impressions of the occasion:

‘It was a morning of mist and low clouds and three Yarmouth boats went off in formation to form part of the escort, Leckie, Fetherston and Fitz-Randolph, with “Fethers” leading. We were to meet a similar formation from Felixstowe, but they never turned up. We went to Orfordness and to the Shipwash light vessel, and then headed out to sea. The first thing I saw was one of our airships, which seemed much the same colour as the mist, and loomed out from the clouds very large all at once. I realized it was part of the escort—*R. 26*, I think.

‘There below was the double line of destroyers and between them the long, thin submarines steaming slowly in line ahead. The destroyers had their guns trained inwards. We broke formation and flew up and down the line a little while and then left and went home. When we left they were almost within sight of other shipping. We had been warned that there must be no demonstration of joy, which would obviously have been in very bad taste, and I remember that the feeling of surrender—that they were now definitely in the inferior position—was so heavily in the air that, as we flew near them low down, I dare not look at the men too hard, for fear of seeming to stare. Just as one doesn’t stare at the mourners following a funeral. Mixed

<sup>1</sup> The War Cabinet—Report for the Year 1918.

up with this, of course, was a strong curiosity to see our enemy at last, clearly and plainly, without having him diving and swirling away before there was time to see him.'

The surrender was continued for some days, but mist prevented further aerial escorts.

The two Zeppelin airships that were surrendered—*L. 64* and *L. 71*—came over to Pulham airship station on July 22 and June 30, 1920, respectively. Captain Fane (who, it may be remembered, played a prominent part in the attack and destruction of *L. 21* on November 28, 1916) witnessed the arrival of *L. 71*, and, describing her descent, stated:

'I was in charge of our landing party at Pulham when the *L. 71* was surrendered, and I don't think I ever saw such an exhibition of airmanship and complete control as the crew of the ship gave. I was simply astounded at the way the Commander<sup>1</sup> brought the ship to the hangar screens; he had his hands on the telegraphs to the various parts of the ship and his head out of the window, and he manœuvred the ship practically into the shed before he dropped a single landing rope. It certainly did not require more than 50 men to get her in, and there were, I think, 500 standing by.'

With respect to the station there is now little to relate. For some time after the Armistice patrols were made to look for floating mines, but soon demobilization commenced. Major A. B. Gaskell, D.S.C. (one of the earliest of the naval pilots, and an officer of singular charm who had had a distinguished war career in the Near Eastern theatre), succeeded to the command. Lieutenant A. C. Hands was the adjutant at this period.

The authorities decided that the air station was not to be permanent, and so gradually, with a continually decreasing staff, the large numbers of machines and larger quantities of stores which had accumulated were sent to other air stations. Finally, in early 1920, there was left but one officer and six motor-boat ratings to look after the station and to clear out the stores and take them by sea to other stations, for which purpose a large, self-propelled concrete lighter (*R.A.F. 110*) was used.

At last, towards the end of January, the sad day arrived when it was decided that the air station must cease to be manned by Service personnel, and must be handed over by nightfall on a named date to civilian caretakers. On that day the White Ensign was hoisted for the last time; the Royal Air Force had then no

<sup>1</sup> Kapitänleutnant Heine.

ensign, and it was not considered fit and meet that on this—the last day—the station should fly no colours.

Slowly the hours dragged on. The lighter was loaded up and at dusk the ensign was hauled down and the keys handed over to the caretaker. The officer ordered his crew aboard the lighter, and then—alone—walked through the deserted and empty sheds—thinking—and hoping—that in time to come, people, paraphrasing what Maurice Baring had said of the late Raymond Asquith, would say of those who had been there that, being what they were, and doing what they did in the way they did it, they had made it a little easier for valiant men elsewhere to win the War.

The tow ropes were cast off, the engine-room telegraphs clanged, and the lighter slid out of the harbour into the teeth of a rising south-easterly gale and headed south. The gaunt buildings of the air station were silhouetted against the grey winter sky, and around the flagstaff—standing out stark—a gull could be seen—slowly wheeling. Despite his sadness, to at least one aboard that ship was born the consolation, expressed since in the words:

“The Royal Air Force is strong in the kind of virtue that propagates itself and attains to a life beyond a life. The tradition is safe.”

*PER ARDUA AD ASTRA*



## INDEX

*Officers and men, who are mentioned more than once in the events described, are here given their highest rank.*

### ABBREVIATIONS

Air Mech. = Air Mechanic

Art. = Artificer

B. = Battleship

B.Cr. = Battle Cruiser

Commr. = Commander

C.P.O. = Chief Petty Officer

Cr. = Cruiser

Eng. = Engineer

Flt. = Flight

Ger. = German

L.Cr. = Light Cruiser

Ldg. Mech. = Leading Mechanic

Obs. = Observer

P.O. = Petty Officer

Sqdn. = Squadron

S.S. = Steamship

T.B.D. = Torpedo Boat Destroyer

Warr. Off. = Warrant Officer

W/T = Wireless Telegraphy

### German

Fregattenkap. = Fregattenkapitän

Kap. = Kapitän

Kap.-leut. = Kapitänleutnant

Korv.-kap. = Korvettenkapitän

Oberleut. = Oberleutnant

A.B.C. Motors, Ltd., 293.

Aberdeen, 23.

*Actaeon*, Torpedo School Ship, Naval Wing head-quarters, 11, 18, 38.

Advisory Committee for Aeronautics, 3.

Aerial Defence, taken over by Admiralty, 118 ff.; by War Office, 169-70.

Aerial Navigation Bill, 1910, 4; Aerial Navigation Act, 1911, 4-5.

Aeroplanes, early construction, 8-9, 84-5; flying of, compared with that of seaplanes, 31-4; in R.N.A.S. Aug. 1914, 81-2; production, 152-4, 209-10, 287-9; 'Camels' flying off lighters, 392-4, 415 ff.

Types: Avro, 9, 148; Barber (Valkyrie), 11; B.E. 2c, 84, 139, 148; Bristol 'Bullet', 149; D.H. 4, 258, 289, 379; D.H. 9, 379; D.H. 9a, 380; Farman, Horace, 195; Farman, Maurice, 35-6; R.E. 1, 84; Short, 8; Sopwith Camel, 290; Sopwith Pup, 211; Sopwith Tabloid, 41, 148-9; Sopwith two-seater 'Spinning Jenny', 148; Sopwith 1½-Strutter, 210-11.

*Africa*, B., flying off, 13.

Agadir, *Panther* incident at, 12.

Ahhorn, Ger. air station, 273, 277, 327 f., 407; journeys made by airships stationed at, 346; wreck of, 347.

Air Battalion, 17.

Air Board (first), 207-9; (second), 284-7.

Air Board Order, The, 1917, 209.

Air Committee (first), 15-16, 24; (second), 205.

Air Council, 373-4.

Air Department, Admiralty, 18, 24 ff., 27, 58, 76, 100 f., 140, 145 f., 149, 212.

Air Force (Constitutional) Bill, 1917, 287, 373 f.

Air mechanic, defined, 39.

Air Ministry, 285 ff.

Air raids, *see* German Air Service; Yarmouth, Great, air station.

Air Services, administrative reforms, 145-6, 204 ff., 284 ff.

Air stations, coastal, founding of, 23; grouping, 59-60; take over Coastguard Service, 62.

Aircraft Manufacturing Co., Ltd., 36, 289.

'Airship-plane' experiments, 142, 168-9.

- Airships, advantages over aeroplanes, 2; *The Mayfly*, 3, 9-10; forms of protection against, 5; experiments abandoned, 11; Naval Airship Section disbanded, 14-15; naval officers visit France, Austria, and Germany, 20; Airship Section reconstructed, 23; purchase of foreign, 40; Army Airship Section transferred to Naval Wing, 68; at Spithead Naval Review, 76 ff.; in R.N.A.S. Aug. 1914, 82; aeroplanes released from, 419-20.
- TYPES:**
- British, Non-Rigids:** Astra Torres (No. 3), 24; Beta, 21; Gamma, 21; Willows (No. 2), 24. **Rigids:** *Mayfly* (No. 1), 3, 9-10; *R.* 9, 40.
- German:** Parseval, 316; Schütte-Lanz, 316; Zeppelins, 89-90, *L.* 3, 316-17, *L.* 10, 141, 155-6, 164, 317, *L.* 20, 318, *L.* 30, 196, 319-20, *L.* 53, 321, *L.* 70, 321, *L.* 100, 321-2, *L.Z.* 38 (*L.* 10), 317. *See also* German Air Service.
- Albertville**, Belg. S.S., 181.
- Aldeburgh** night landing-ground, 128, 140, 371, 377.
- Aldis** (machine-gun) sight, 295 f.
- Aldwell**, Eng.-Lieut. G. W. S., R.N., 18.
- Allan**, Surg. J. C. A., R.N., 371.
- Allen**, Warr. Off. R. E. A., 371.
- Amlwch** (Anglesey) W/T station, 152.
- Ammunition**, anti-aircraft, 223-4; Brock bullet, 223; Buckingham, 223; Pomeroy, 223-4; S.P.G., 223.
- Anderson**, Flt. Sub-Lieut. S., 283.
- Anderton**, Lieut. G. B., 426 n. 2.
- Anti-aircraft Corps**, 119.
- Anti-aircraft defence**, *see* Aerial Defence.
- Anti-submarine patrols**, *see* Patrols.
- Anvers**, 100.
- Arabis**, sloop, sunk, 170.
- Aretusa**, L.Cr., mined, 170.
- Arlingham-Davies**, Flt. Sub-Lieut. W., 169.
- Armament** in aircraft, 64-5, 71, 86-7, 142, 150-1, 218 ff., 294-6; in Zeppelins, 325-7. *See also* Hale rifle
- grenade; *Le Prieur* rockets; Ranken darts.
- Armitt**, Lieut. H. C., 407.
- Armstrong**, Whitworth & Co., Ltd., 40.
- Arrol Johnston Co., Ltd.**, 293.
- Ashby**, Air Mech., 245.
- Asquith**, Rt. Hon. H. H., 12.
- Asquith**, Raymond, 429.
- Aviation**, Admiralty's early policy, 1 ff.; commission visits France, 4; naval functions outlined, 13.
- Babington**, Sub-Lieut. J. T., 44.
- Bachmann**, Ad., 131 f.
- Bacon**, Capt. R. H. S., R.N., 2 f.
- Bacton** night landing-ground, 128, 179, 187, 197, 259, 274, 371.
- Bailhache**, Sir Clement, 206.
- Baird**, Maj. J. L., 208, 284, 373.
- Balloon**, kite, flown from the *Hercules*, 185.
- Balloon School**, 17.
- Balloon Section**, Kite, Lowestoft, 377.
- Bannerman**, Lt. Commr. B. S., R.N., 267 ff., 271.
- Barber**, H., 11.
- Baring**, Maurice, 429.
- Barker**, Capt. A. T., 394, 396, 398.
- Barnsley**, bombed, 196.
- Barr**, Flt. Lieut. F. M., 103, 110, 125.
- Barrington-Kennett**, Lieut. B. H., 18.
- Barrow-in-Furness**, 3, 10 f.
- Barwell**, Lieut. B. E., 407.
- Battle Cruiser Fleet**, *see* Fleet.
- Battle Cruiser Squadron**, First, 176, 281.
- Beardmore & Co.**, William, Ltd., 25, 110.
- Beare**, Flt. Sub-Lieut. S. C., 174.
- Beatty**, Ad. Sir David, 108, 170, 172, 177, 183.
- Beaumont**, Corp. ('E'), 394.
- Beaver**, Obs. Lieut. L. C., 283, 387.
- Becker**, Oberleut. H., 234 n., 302 n. 1.
- Beckett**, Sub-Lieut. L. V., R.N.R., 371.
- Bell**, Obs. Lieut. A. P., 283, 387.
- Bell**, 2nd Lieut. O. D., 426 n. 2.
- Bell**, Lieut. R.N., 403.
- Bellinger**, Lieut. P. N. L., U.S.N., 213 n.

- Benitz, Lieut. F. A., 414.  
*Ben-my-chree*, aircraft-carrier, 281.  
 Berchem Ste Agathe, Ger. airship sheds at, 129.  
 Berthold, Kap.-leut., 114 f.  
 Bertram, Kap.-leut., 112, 156, 300.  
 Bethmann-Hollweg, von, Ger. Chancellor, 117, 132.  
 Betts, Obs. Lieut. E. B. C., 259 f., 283.  
 Beverley air station, 191.  
 Bicknall, Flt. Sub-Lieut. J. N., 283.  
 Bicknall, Lieut. W. H., 426 n. 2.  
 Bicknell, Lieut. F. R., 370, 413.  
 Binyon, Lieut. B., R.N.V.R., 151.  
*Birchgrove*, S.S., 239 f.  
 Bird, Flt. Lieut. E. J. M., 158.  
 Bittles, Flt. Lieut. G. H., 175, 195, 250.  
 Blacker, Capt. L. V. Stuart, 221 f.  
 Bloom, Lieut. G. F. H., 426 n. 2.  
*Blücher*, Ger. Cr., 106 f.  
 'Bob', watch-dog, 38.  
 Bobbett, Warr. Off. H. C., 65, 101, 138.  
 Böcker, Kap.-leut., 124, 136, 138, 165, 171, 191.  
 Bockholt, Kap.-leut., 339.  
 Bödicker, Ad., 173.  
 Boegendorff, Kap.-leut. von Tschirschky von, 231.  
 Bolton, Capt. E. A., 268 ff., 280, 349 ff., 352 n., 359, 394, 397, 401.  
 Bomb dropping, experiments, 14, 64-5.  
 Bomb gear, 87, 224.  
 Bomb sights, 87, 218-19; the C.F.S. scale, 151; Goertz, 232-3; Zeiss, 232.  
 Bombs, 296; light and heavy case types, 151; R.N.A.S., 224; used by Zeppelins, 326-7; Carbonite, 115-16, 232; Hale 20 lb., 87, 109; 'P. und W.', 232.  
 Bone, Flt. Lieut. R. J., 65 f., 70, 72 f., 101, 103, 105.  
 Boothby, Lieut. F. L. M., R.N., 19, 23.  
 Borkum, Ger. air station, 112 ff., 156, 230 f., 300, 386, 389 ff., 399, 418, 424 *passim*.  
 Boswell, Flt. Sub-Lieut. H. G., 237.  
 Bourne, Pte., 400 f.  
 Brancker, Maj.-Gen. W. S., 208, 373.  
 Brandon, 2nd Lieut. A. de B., 172, 191.  
 Brehmer, Fregattenkap. Fritz, 297 n.  
 Breithaupt, Kap.-leut. Joachim, 166, 171, 335.  
 Brenton, Flt. Lieut. H. B., 202, 252, 362.  
 Bridgman, 2nd Lieut. L. L., 426 n. 2.  
 Briggs, Commr. E. F., 19, 205.  
 Bright, Charles, 206.  
 Bristol Flying School, Brooklands, 101.  
 Brock bullet, 223.  
*Brocklesbury*, seaplane-carrier, 126.  
 Brodrück, Oberleut., 191.  
 Brosse, Lieut. H. A., 426 n. 2.  
 Brown, Pte. (W/T), 394.  
 Brown relay receiving apparatus, 88.  
 Browne, Balfour, J. H., 206.  
 Brownlee, Air Mech. J., 102.  
 Bruges, Ger. meteorological station, 167, 272 f.  
*Brussels*, S.S., 113.  
 Buckingham, J. F., 223.  
 Buckingham bullet, 223.  
 Budd, Flt. Sub-Lieut. V. J., 283, 361 f.  
 Bull, Serg., 413.  
 Bungay, bombed, 186.  
 Burge, Lieut. G. R., 283, 426 n. 2.  
 Burgh Castle air station, 128, 140, 192, 274, 377, 402, 408, 413.  
 Burney, Ad. Sir Cecil, 281.  
 Burntwick Island W/T station, 21.  
 Burstead, Great, *L.* 32 brought down at, 190-1.  
 Burton, Lieut. F., 426 n. 2.  
 Burton, Pte. ('E'), 394.  
 Bury St. Edmunds, bombed, 125.  
 Butcher, J. G., 206.  
 Butler, Lieut. V. S., R.N., 107.  
 Buttlar, Kap.-leut. Freiherr von, 121, 124, 135 ff., 273 f., 279.  
 Bylaugh Park, bombed, 138.  
 Cadbury, Maj. Egbert, 134 and n., 136, 141, 171, 179-80, 187, 190, 194, 197 ff., 240, 251, 274, 361, 377 ff., 384, 386, 392, 408 ff., 412, 414, 421 n.  
 Cadbury, George, 409.  
 Caddell, Lt.-Col. W. B., 222.

- Callaghan, Ad. Sir George, 46, 79.  
 Calshot air station, 35, 62, 66, 68, 71,  
 77 ff., 81, 86, 101, 226.  
*Campania*, seaplane-carrier, 211.  
 Campbell, Air Mech., 105.  
 'Canard' type, aeroplane, 11.  
*Cantatrice*, seaplane-carrier, 126.  
 Caple, Air Mech. W. J., 102.  
 Carmichael, Lieut. E. H., R.N.V.R.,  
 283.  
 Carnwath, Lieut. the Earl of, R.N.V.R.,  
 104.  
 Cass, Obs. Sub-Lieut. W. B., 370.  
 Caswell, Flt. Sub-Lieut. B. B., 283.  
 Central Air Office, Sheerness, 99, 109,  
 145.  
 Central Flying School, Upavon, 17-18,  
 26, 39, 73, 75, 79, 101, 225.  
 Chambers, Lt.-Col. Ennis T. R., 100,  
 425.  
 Chapman, Warr. Off. A. G., 371.  
 Chapman, Flt. Sub-Lieut. C. H. M.,  
 181.  
 Chapman, Pte. ('E'), 283, 362, 380,  
 386, 394.  
 Chase, Pte. W., 391 n. 1.  
 Chelmsford, bombed, 136.  
 Cheshunt, bombed, 192.  
 Chesterton, bombed, 196.  
 Chingford air station, 226.  
 Christiansen, Oberleut., 299, 302, 383,  
 403.  
 Churchill, Rt. Hon. Winston, 40, 47,  
 50, 61, 70, 118, 305 f.  
*City of Bradford*, S.S., Borkum living-  
 quarters, 156, 230.  
 Clacton air station, 81, 88, 99.  
*Clara Mennig*, Ger. merchant steamer,  
 55 f.  
 Clark-Hall, Lieut. R. H., R.N., 64, 67,  
 71.  
 Cleethorpes air station, 16, 23, 60.  
 Clowes, C.P.O., 102.  
 Clyde, River, 23.  
 Coast Defence Station, Gt. Yarmouth,  
 taken over by R.N.A.S., 63, 104.  
 Coastguard Service, taken over by  
 coastal air stations, 62.  
 Cockburn, C. B., 6 f.  
 Colley, Maj. C. C., 221 f.
- Committee of Imperial Defence, 2, 12,  
 15, 20, 23.  
 Compasses, adapted for aircraft, the  
 R.A.F. Mark II, 225.  
 Comstock, Lieut. W. H., 283, 391.  
 Constantinesco, M., Rumanian en-  
 gineer, 221 ff.  
 Constantinesco synchronizing gears, 294.  
 Cooper, Flt. Lieut. E. J., 134, 141.  
 Cooper, Pte. ('E'), 404 f.  
 Copland-Perry, E. W., 14.  
 Cotes-Predy, Mr., 206.  
 Cotton, Flt. Lieut. F. S., 259.  
 Cotton Powder Co., Ltd., 151.  
*Courageous*, Cr., 281.  
 Courland, Ger. air station, 231.  
 Courtney, Sqdn. Commr. C. L., 34 ff.,  
 48, 65, 70, 77, 79, 101, 103.  
 Covehithe air station, 128, 140, 179,  
 187, 274, 371, 377, 408, 413.  
 Cowdray of Midhurst, Right Hon. Vis.,  
 284 ff., 373.  
 Cranwell air station, 191, 225.  
 'Crashometer', 26.  
 Cresswell, Lieut. T. S., R.M.L.I., 35,  
 38, 48, 74.  
 Cripps, Flt. Lieut. J. M. R., 110, 137 f.,  
 141.  
 Crisp, Flt. Sub-Lieut. E. J., 202.  
 Cromarty air station, 23, 48, 51, 54, 57.  
 Cromer, 16, 23, 28.  
 Crook, Ldg. Mech., 349.  
 Cross, Capt. B. C. H., 282 f., 380, 387.  
 Cruiser Squadron, First, 281; First and  
 Sixth Light Cruiser Squadrons, 281.  
 Cuffley, S. L. 11 brought down at, 185.  
 Culley, Lieut. S. D., 370, 415 ff.  
 Cumming, Lieut. W. N., 426 n. 2.  
 Cunliffe, Flt. Sub-Lieut. P. W., 370.  
 Curtiss, Glen, 212-13.  
 Curzon, Lieut., 126.  
 Curzon, Lord, 207 f.  
 Cussen, Flt. Lieut. J. B., 139, 283.  
 Cuxhaven, Ger. air station, 92; raided,  
 112-13, 119, 169.  
*D. 5*, submarine, mined, 108.  
 Daddo-Langlois, Flt. Sub-Lieut. W. J.,  
 283.  
 Daimler Engine Co., 110.

- Dampier, Eng.-Room Art. P., 102.  
 Danzig, aeroplane sheds at, 90.  
 Darkening regulations enforced, 130.  
 Darwin, Horace, 3.  
 Davern, Flt. Sub-Lieut. W. A. N., 256, 271.  
 Davies, Warr. Off. A. H., 181.  
 Davis 6-pdr. gun, 124.  
 Dawson, F. G. T., 123.  
 Deary, C.P.O., 102.  
 'Deauville' floats, 66.  
 Deck, flying from, 13, 54 n., 212, 415; lighter experiments, 392-4.  
 Deeley, Pte. (W/T), 361 and n. 2, 362, 380, 394.  
 Defence of the Realm Act, 420.  
 Dehn, Oberleut., 230.  
 DELAG, German Airship Transport Company, 328.  
 Denes, South, Gt. Yarmouth, site of air station, 28 ff.  
 Department of Military Aeronautics, 206.  
 Derby, Lord, 205.  
 Dereham, East, bombed, 138.  
 Dibowski, M., Russian engineer, 220.  
 Dickey, Capt. R. F. L., 249, 384, 394 ff., 399.  
 Dietrich, Kap.-leut. Max, 165, 196, 240.  
 Dietrich-Bielefeld, Kap.-leut., 171.  
 Dingley, Pte. (W/T), 404 f.  
 Directional Finding Stations, erection of, 151-2.  
 Director of Air Department, 146.  
 Director of Air Services, 146.  
 Döberitz (Ger.) Military School, 90.  
 Dodd, Ship's Steward, R.N., 105.  
 Dorchester, 79.  
 Dose, Kap.-leut. Walter, 407, 410 f.  
 Dover, bombed, 120; *L.* 12 hit, 135, 155.  
 Dover air station, 16, 23, 188, 191, 406.  
 Dresden, Ger. air station, 328 f.  
 Duff-Fyfe, Lieut. M. T. R., 394.  
 Dundee air station, 77, 81.  
 Dunkerque air station, 100, 189.  
 Dunn, Sub-Lieut. J. H., R.N.V.R., 181.  
 Düsseldorf, airship shed destroyed, 119.  
 Duty Pilots, 178.
- E. 23, submarine, the *Westfalen* torpedoed by, 183.  
 Eagle, R.N.A.S. emblem, 76.  
 Eastbourne Aviation Co., 123.  
 Eastbourne Aviation School, 101.  
 Eastchurch air station, 6 f., 11, 14, 23, 39, 71, 73, 79 ff., 88, 100 f., 123, 191.  
 Eaton, Ensign, U.S.N., 394, 396, 398.  
 Edler, Oberleut., 159.  
 Edwards, R. (C.P.O.), 73, 102, 105.  
 Edwards, Air Mech. W., 102.  
 Ehrlich, Kap.-leut., 166.  
 Eichler, Kap.-leut., 250, 252.  
 Eiffel Tower W/T station, 42.  
 Ellington, Col. E. L., 205.  
 Ellis, Flt. Sub-Lieut. S. J. C., 283, 361 and n. 2, 362.  
 Ellison, Commodore A. A., R.N., 175, 197 ff., 266, 377, 414.  
 Ellyson, Lieut. T. G., U.S.N., 14.  
 Empress, aircraft-carrier, 100, 169.  
 Engadine, seaplane-carrier, 100, 112; at Jutland, 176.  
 Engines, British built, Aug. 1914, 82-3; output in 1914 and 1915, 154; development in 1916, 215-16, in 1917, 293-4; German types, 95-6; used in Zeppelins, 322-3.  
 Eppinger, 2nd Lieut. F., 426 n. 2.  
 Esher, Vis., 2, 5.  
 Essendon, bombed, 185.  
 Evans, Flt. Sub-Lieut. D. C., 174 f.
- Faber, Kap., 159.  
 Fairey Aviation Co., Ltd., 211, 290.  
 Fairnes, Ldg. Mech. W., 253.  
 Falkenhayn, Gen. von, 131 f.  
 Falmouth, Cr., sunk, 184.  
 Fane, Capt. G. W. R., 139, 141, 173, 197 ff., 252, 259 f., 283, 402, 413, 428.  
 Farman, Henri, 66.  
 Farnborough, 15, 23, 74, 81.  
 Fawcett, Capt. H. R., R.M.L.I., 60, 65, 73, 79, 101.  
 Felixstowe air station, 35, 77, 79, 81, 88, 100, 179, 195, 214, 237, 244, 249, 290, 351, 366, 377, 383 f., 392, 394 f., 400, 402, 415 f., 424 f. *passim*.

- Ferdinand, Franz, Archduke of Austria, 79.  
 Ferrier, Midshipman R. England, 102.  
 Fetherston, Capt. S. J., 202, 257, 264, 266, 283, 349, 359, 391, 413, 416, 427.  
 Feuerhaak, Oberleut.-Maschinist, 159.  
 Filey air station, 23.  
 Finch-Noyes, Flt. Lieut., 87.  
 Fischer, M. (Belgian pilot), 66, 73.  
 Fisher, Lord, First Sea Lord, 2, 10, 305 f.  
 Fitzmaurice, Lieut. Raymond, R.N., 19, 22, 42 ff., 55.  
 FitzRandolph, Capt. A. M., 202, 387 ff., 427.  
 Flamborough Head W/T station, 152.  
 Fleet, Battle Cruiser, 183.  
 German High Sea, 163 f., 170, 172, 182, 193, 229 f., 239, 381 f., 426.  
 Grand, 108, 164, 172, 183 ff., 301, 382.  
 Flemming, Oberleut., 279.  
 Flying-boats, development, 212 ff., 290-3; air engagements with, 236 ff., 394 ff.; patrols with, 348 ff., 377 ff., 385-6; mooring difficulties, 358.  
 TYPES: 'F' (Felixstowe), 292; F. 2a, 292-3, 352 ff.; H. 12, 292.  
*See also* Seaplanes.  
 Fokker, Anthony, 219.  
 Fort Grange seaplane station, 81.  
 Fowler, Capt. P. K., 426 n. 2.  
 Franco-British Aviation Co., 215.  
 Frankenberg, Kap.-leut., 200.  
 Fredensburg, Oberleut., 301.  
 Frege, Oberleut., 300.  
 Freimel, Oberleut., 193, 279.  
 French, Field Marshal Sir John, 50.  
 Freudenreich, Kap.-leut. von, 279, 407, 409.  
 Frey, Oberleut. Richard, 200, 247, 255, 256 n., 258, 262, 275 ff.  
 Friedensburg, Oberleut., 231.  
 Friedrichshafen, bombed, 119.  
 Frieston training station, 225.  
 Fritz, Kap.-leut., 121.  
 Fuhsbüttel, Ger. air station, 121, 328.  
 Fulton, Capt. J. D. B., R.F.A., 26.  
 Furious, aircraft-carrier, 403.  
 Gainsborough, bombed, 186.  
 Galatea, L.Cr., *L.* 7 brought down by, 176.  
 Galloway, 2nd Lieut. R. H., 426 n. 2.  
 Galpin, Flt. Commr. C. J., 180 ff., 189 f., 195, 237 ff., 241 f., 245 ff., 249, 254 f., 258, 264, 266, 348 f.  
 Galpin, Maj. J. O., 400.  
 Galwayne, Lieut., 394, 398.  
 Gamble, Lieut. C. F. Snowden, 407.  
 Gamble, Maj. Charles W., 152 n. 2.  
 Gammon, Flt. Sub-Lieut. A., 181.  
 Garros, M. (French pilot), 150.  
 Gaskell, Maj. A. B., 428.  
 Gayer, Kap.-leut., 279.  
 Geisler, Oberleut. Hans, 230.  
 George, Rt. Hon. David Lloyd, 286, 373.  
 George, Hauptmann, 136.  
 German General Staff, 228.  
 German Air Service (1912), 20-1; technical development of airship service, 328-9.  
*Zeppelins*, types described, 316 ff.; engines, 322-3; construction difficulties, 324-5; numbers built during war, 325; armament, 325-7; housing problems, 327-8; crews, 329; flight preparations described, 330-5; flights by *L.Z.* 120 and *L.* 59, 338-40.  
 Raids on England, 120 ff., 124-5, 127, 130, 135 ff., 155, 164 ff., 178-81, 185 ff., 195 ff., 240 ff., 272 ff., 336-8, 378-9, 407 ff.; general effects of raids, 227-8, 286.  
 German Naval Air Service, 1884-1914, 89 ff.; strength 1914, 93; types of machines and engines 1914, 94-6; high standard of personnel, 97-8; duties of stations, 112-14; technical difficulties, 115; nomenclature of airships, 127-8; air raid policy, 131-2; records of stations, 156-9, 230-1, 298-9, 300-1, 302; airship performances during raids, 167, 176; naval reconnaissances by airships, 173, 183-4, 229-30; seaplane development, 231 ff., 297 ff., 303-4; torpedo-carrying aircraft, 233-5; airship sta-

- tions in commission during the War, 328; duties of airships, 330; flight preparations described, 330-5; patrol duties, 335-6; airships in commission during the War and their fate, 341-5; journeys made by airships stationed at Ahlhorn, 346.
- Gerrard, Capt. E. L., R.M.L.I., 6, 19 f.
- Gibbs, Pte. (W/T), 420.
- Gilligan, Flt. Lieut. A. H. H., 259 ff.
- Glazebrook, Dr. R. T., 3.
- Glorious*, Cr., 281.
- Goertz-Borjkow aiming tube, 232-3.
- Goldhanger aerodrome, 251.
- Gontrode, Ger. airship station, bombed, 125.
- Gordon, Flt. Commr. Lindsay, 244.
- Gordon, Sqdn. Commr. R., R.M.L.I., 19, 22, 48, 77.
- Gordon, Flt. Sub-Lieut. T. C., 370.
- Grace, Cecil, 6, 8.
- Graham, Flt. Lieut. W. L., 367, 370.
- Graham, Flt. Lieut., 189.
- Grahame-White Flying School, Hendon, 101.
- Grain, Isle of, air station, 25, 62, 77, 79, 81, 88, 99, 169, 188.
- Grand Fleet, *see* Fleet.
- Grant, Air Mech. A., 246, 253, 359, 380, 390 f.
- Grant, Flt. Sub-Lieut. J. C., 283.
- Graudenz, Ger. L.Cr., 106.
- Gravesend, bombed, 186.
- Gray, 2nd Lieut. E., 412.
- Gray, Obs. Sub-Lieut. R., 370.
- Green, Lieut. V. S., 370, 420 f.
- Green Engine Co., Ltd., 110.
- Greenhill, Sir A. G., 3.
- Greenwood, Pte. (G/L), 404 ff.
- Gregory, Sqdn. Commr. R., 6, 12, 19 f., 34 f., 38, 48, 60, 65, 69 f., 100 f., 105, 109.
- Grey, Sqdn. Commr. S. D. A., 19, 22, 35, 212.
- Grimsby, bombed, 130.
- Grohman, Lieut. Baillie, R.N., 107.
- Gronau, Oberleut. W. von, 158 n. 1, 297.
- Ground Directional Finding W/T set, 225.
- Ground organization, lack of, on anti-airship operations, 143.
- Groves, Commr. R. M., R.N., 146, 208.
- G.R.W. Wheel Float Attachment, 69.
- Guard, Lieut. H. P., 426 n. 2.
- Hackney, Ch. Eng.-Room Art. H., R.N., 69, 73, 102, 105.
- Hadden, Maj.-Gen. Sir Charles, 3.
- Haegen, Oberleut. von der, 129.
- Hage, Ger. air station, 328.
- Haggerston, Maj. T., 370, 388, 394, 397.
- Hague Declaration, 1899, 1907, and bombing by aircraft, 117-18.
- Haines, Air Mech., 195.
- Halcyon*, gunboat, 106 ff., 267 ff., 271, 405 n.
- Haldane of Cloan, Vis., 12.
- Hale, Marten, 87.
- Hale rifle grenade, used in aircraft, 64, 87.
- Halford-Thompson, Flt. Lieut., 257, 274.
- Hall, Flt. Lieut. H. G., 174 f.
- Hallam, Sqdn. Commr. T. D., 366 n.
- Halliday, Flt. Sub-Lieut. G. R., 202.
- Halstead, Flt. Sub-Lieut. F. N., 139, 141.
- Hamburg, Ger. airship school at, 329.
- Hands, Lieut. A. C., 428.
- Hankey, Sir Maurice, 12, 205.
- Hards, Flt. Lieut. F. G. D., 141, 174 f., 348.
- Hardwick, Arkell, 25.
- Harman, Pte. A. T. (G/L), 414.
- Harper, B. J. (C.P.O.), 102.
- Harris, 2nd Lieut. H. G., 426 n. 2.
- Hartlepool, West, L. 34 brought down off, 195-6.
- Hartley, Lieut. A. E., R.N.V.R., 256 f.
- Hartog, Kap., 170.
- Harwich, 14, 16, 23, 88; bombed, 186.
- Harwich Light Cruiser Force, 106, 112, 183 f., 415, 424, 427.
- Haughley, bombed, 186.
- Haverhill, bombed, 187.
- Havilland, Capt. Geoffrey de, 84, 289, 379.
- Hawker, Flt. Sub-Lieut. A. E., 139.

- Hawker, Harry, 148.  
 Hawker, Lieut. L. G., 125.  
 Hayman, Eng.-Room Art. C. H. V., 102.  
 Haythorpe, Air Mech., 272.  
 Heiligendamm seaplane competition, 91.  
 Heine, Kap.-leut., 428 n.  
 Heinkel, Ernst, 303.  
 Helgoland, Ger. air station, 92, 114, 301.  
 Helgoland Bight, 112, 158; operations in, 415 ff.  
 Henderson, Lt.-Gen. Sir David, 12, 205, 208, 284, 373 f.  
 Henderson, Air Mech., 350 n., 351.  
 Hendon air station, 101, 259.  
 Hendry, I. C. (P.O.Tel.), 73, 102 f., 109.  
 Hennessey, 2nd Lieut. M. J., 426 n. 2.  
*Hercules*, B., kite-balloon flown from, 185.  
*Hermes*, Naval Wing head-quarters and seaplane-carrier, 3, 38-9, 46, 48 ff., 53 ff., 60, 62; torpedoed, 39.  
 Hervey, Sir H. Paul, 208.  
 Herzfeld, Ger. midshipman, 113.  
 Hesketh, 2nd Lieut. R. N., 426 n. 2.  
 Hewlett, Sub-Lieut. F. E. T., R.N., 19, 48.  
 Heybridge, bombed, 124.  
 Heywood, Warr. Off. W. R., 182, 203, 371.  
*Hibernia*, H.M.S., flying off, 20.  
 Hickling Broad, Norfolk, 60-1, 420.  
 Hicks, Flt. Commr. W. C., 142.  
 Hicks, W. Joynson, 374.  
 High Sea Fleet, *see* Fleet.  
 Hilliard, Flt. Sub-Lieut. G. W., 135 f., 138.  
 Hippé, Ad., 114.  
 Hobbs, Flt. Sub-Lieut. B. D., 249.  
 Hobbs, Flt. Sub-Lieut. J. W., 181.  
 Hodges, Lt.-Commr. F. W., R.N.V.R., 181, 371.  
 Hodgson, Lieut. G., 244, 404 f.  
 Hodgson, Commr., R.N., 266.  
 Hodson, Flt. Sub-Lieut. G. F., 283, 400, 413.  
 Hodson, Capt. John, 394, 396 ff., 412, 420.  
 Hodson, Lieut., 394.  
 Holder, Gen. von, 229.  
 Hollender, Kap.-leut., 255, 274, 276 n., 279.  
 Holm Island, Ger. aeroplane sheds at, 90.  
 Holman, Flt. Sub-Lieut. H. S., 370.  
 Holt, Lt.-Col. H. S., 123.  
 Holt flares, 123 n. 1.  
 Holt night landing-ground, 128, 179, 197, 371.  
 Hooks, Ldg. Mech., 133.  
 Hopcraft, Flt. Lieut. E. G., 299 n. 3.  
 Hopkins, Pte. (W/T), 394.  
 Hopkinson, Maj. Bertram, 220, 222 f.  
 Horn, Hauptmann, 136.  
 Hornby, Flt. Commr. C., 139.  
 Hudson, Flt. Sub-Lieut. G. A. T., 370.  
 Hughes, 2nd Lieut. D. W., 270.  
 Hull, bombed, 130.  
 Humberstone, bombed, 186.  
 Humphrey, Maj., 426 n. 2.  
 Hunt, H., 47.  
 Hunter, Sir John, 373.  
 'Hydro-aeroplane', re-termed 'seaplane', 39-40.  
 Inspecting Captain of Aircraft, 3, 62.  
 International Conference on Aerial Navigation (Paris, 1910), 4.  
 Interrupter gears, definition of, 220; Hazelton, 294; Scarff-Dibowski, 220; Sopwith-Kauper, 220, 294; Vickers, 220. *See also* Synchronizing gears.  
 Ipswich, bombed, 125, 186.  
 Ireland, Sqdn. Commr. W. P. de Courcy, 109 f., 125, 133 ff., 139 ff., 164 f., 168 f.  
 Iron, Capt. C. S., 202, 252, 274, 412.  
 Ivermee, Lieut. R. W. A., 400 f., 407.  
 James, Capt. C. H., 407.  
 Jardine, Capt. B. G., 412 f.  
 Jellicoe, Ad. Sir John, 46, 170, 172, 183, 229.  
 Jenkin (machine-gun) sight, 296.  
 Johannisthal, Ger. airship school, 329.  
 Jones, P.O., 105, 133.

- Judicial Committee on air 'murder charges', 206-7.
- Jueterborg, Ger. air station, 328 f.
- Jupp, Pte., 380.
- Jutland, Battle of, aircraft co-operation in, 176-7.
- Kankakee*, S.S., sunk, 250.
- Keeble, Capt. L. C., 426 n. 2.
- Kelling, Serg., 413.
- Kemball, Flt. Lieut. S., 169, 174, 187.
- Kerr, R.-Ad. Mark, 373.
- Kershaw, Sub-Lieut. R. H., R.N.R., 65 f., 68, 101.
- Keyes, V.-Ad. Sir Roger J. B., 382.
- Keys, Lieut. R. E., 407, 414, 419.
- Keys, Ensign, U.S.N., 394.
- Kidd, 2nd Lieut. L. W., 426 n. 2.
- Kiel, Ger. air station, 92, 328.
- Killingholme air station, 60, 81, 100, 103, 179.
- Killingholme*, seaplane-carrier, sunk, 126.
- Kilner, Flt. Commr. B. D., 169, 174, 177, 182, 189, 299 n. 3.
- King, 2nd Lieut. C. P., 426 n. 2.
- King, Flt. Lieut. L. L., 370.
- King Stephen*, armed trawler, and the L. 12, 166 f.
- Kingfisher*, seaplane-carrier, 126, 137, 139.
- King's Lynn, bombed, 122.
- Kingsnorth air station, 40, 79, 81, 169.
- Kirkistown W/T station, 152.
- Kirkpatrick, Capt. C. D., 407, 413.
- Kite, box-, communication by, 350 f.  
See also Balloon.
- Kolberg*, Ger. L.Cr., 106.
- Kölle, Kap.-leut. Waldemar, 272 f., 275, 277 f.
- Kreige, Herr, 4.
- Kruger, Leut. von, 414.
- Lanchester, F. W., 3.
- Lan-Davies, Flt. Sub-Lieut., 103, 109 f.
- Larne W/T station, 152.
- Latter, Air Mech., 105.
- Laycock, Air Mech. O. R., 237, 239, 242.
- Le Prieur, Lieut. Y. P. G., 195 n.
- Le Prieur* rockets, experiments, 195.
- Lea Bridge, bombed, 190.
- Leaman-Berry, Sqdn. Commr. A., 283.
- Leckie, Maj. R., 192, 202, 236 ff., 242, 245 f., 253 ff., 260 ff., 271, 280, 348 f., 352, 359, 362 ff., 377, 379 ff., 385, 388, 391, 394 ff., 399 f., 408 ff., 412, 414, 416, 427.
- Lee, Flt. Sub-Lieut. B. R., 141, 168.
- Lee-on-Solent air station, 226.
- Lehmann, Oberleut. Ernst A., 338.
- Leipzig, Ger. air station, 328 f.
- Leopard*, T.B.D., 107.
- Leslie, Flt. Sub-Lieut. N. W., 192, 202.
- Lettow-Vorbeck, Gen. von, 339 f.
- Leven air station, 48, 52, 54.
- Lewis, Ass.-Paymr. D. J., R.N.R., 181.
- Leyton, bombed, 136.
- Leytonstone, bombed, 136.
- Lidderdale, Ass.-Paymr. J. H., R.N., 19.
- Lighters, flying from, 392-4, 415 ff.
- Lilunfeld, Oberleut., 300.
- Lincoln, Air Mech., 105.
- Linnarz, Hauptmann, 127, 129.
- Lisseveghe, Ger. aircraft base, 159.
- Lively*, T.B.D., 107.
- Livock, Capt. G. E., 202, 349, 352, 359, 362 ff., 379 ff., 385.
- Lizard, the, 16, 23; W/T station, 152.
- Llewellyn, 2nd Lieut. C. W. B., 426 n. 2.
- Loewe, Kap.-leut., 138, 165 f.
- London, bombed, 136, 138, 185, 190 f., 273, 286, 336 *passim*.
- London*, B., flying off, 20.
- Longmore, Sqdn. Commr. A. M., 6 f., 13, 19, 48, 77.
- Lorenz, Oberleut., 230.
- Lossnitzer, Kap.-leut. von, 407.
- Lowestoft, bombed, 135, 171; bombarded, 174 f.
- Lowestoft Kite Balloon Section, 377.
- Lowestoft W/T station, 152.
- Lucas, Dr. Keith, 225.
- Lucas, Col., 71.
- Lucas Mark II R.A.F. compass, 225.
- Luckstead, Lieut. G. E., 371.
- Lurie, Eng.-Room Art. V., 102.
- Lushington, Lieut. G. Wildman, R.M.A., 6.

- Lusitania*, S.S., sunk, 306.  
 Lydd W/T station, 152.  
 Lyst, Ger. air station, 114.  
 Lytton, P.O., 125.
- McAnally, H. W., 373.  
 McArton, Air Mech., 72.  
 McCann, Lieut. C. W., R.N.V.R., 283.  
 McClean, Francis, 6, 8 f., 11.  
 McClean, Sqdn. Commr. Frank K., 140.  
 McDiarmid, Flt. Sub-Lieut. H. N., 181.  
 Macfadyen, Lieut. F. J. R., R.N.V.R., 283.  
 MacFarlane, Lieut. A., 426 n. 2.  
 Machine-guns in aircraft, experimental work, 64, 66-8, 150-1; Lewis, 218, 295; Spandau, 231; Vickers, 218, 294-5; in Zeppelins, 325-7.  
 MacLauren, Capt. C., 384.  
 MacMillan, Obs. Sub-Lieut. A. D., 370.  
 Magor, Capt., U.S.N., 383.  
 Maldon, bombed, 124.  
 Mallock, H. R. A., 3.  
 Malone, Lieut. C. J. L'Estrange, R.N., 18 ff., 22 f., 27 f.  
 Manger, Hauptmann, 273, 279.  
 Mans, Oberleut., 156, 159, 231.  
 Manston air station, 403.  
*Marguerite*, motor-boat, 39.  
 Martin, 2nd Lieut. C., 426 n. 2.  
 Martin, Percy, 284.  
 Martin, Lieut. S. P., R.N.V.R., 371.  
 Masius, Hauptmann, 129.  
 Maskell, Flt. Commr. A. S., 283.  
 Masterman, Wing Commr. E. A. D., 19, 23, 146.  
 Mathy, Kap.-leut. Heinrich, 129 f., 138, 165, 171, 190, 192 f.  
 Maude, Flt. Lieut. C. E., 65, 101.  
 Maxwell, J. (C.P.O.), 102.  
 Maxwell, Sub-Lieut. J. E., R.N.V.R., 181.  
 May, Ad. Sir William, 46.  
 Menzing, Kap., 90.  
 Michelin bomb-dropping competition, 87.  
 Mieth, Oberleut., 252.
- Miller, Warr. Off. S. H., 371.  
 Mills, Flt. Sub-Lieut. J. S., 130.  
 Ministry of Munitions, 152, 284, 288 f.  
 Moffett, R.-Ad. W. A., U.S.N., 229.  
*Moltke*, Ger. B.Cr., 106 f., 382 and n. 3.  
 Monaco seaplane contest, 58.  
 Money, Pte. J. N., 177, 380, 390 f.  
 Monsell, Commr. Eyres, 350.  
 Montagu, Lord, 205.  
 Morane, Léon, 41.  
 Morris, Flt. Sub-Lieut. E., 283, 349.  
 Morris, Flt. Sub-Lieut. H. M., 242 ff.  
 Mortimer Singer Prize, 1913, 212.  
 Moscicki condenser, 88.  
 Mossop, Capt. E. A., 283, 361 and n. 3, 362, 394, 397, 404 f., 413.  
 Munday, Lieut. E. R., 387, 412 f.  
 Murray, Flt. Sub-Lieut. L. E. R., 192, 202.  
 Musson, Flt. Sub-Lieut. F. G. S., 370.
- Nairana*, aircraft-carrier, 415.  
 Napier, V.-Ad. T. D. W., 281.  
 Narborough night landing-ground, 128, 140.  
 Nathasius, Oberleut. von, 196.  
 National Physical Laboratory, 4, 84.  
 Naval Flying School, Eastchurch, 18, 73, 109.  
 Nelson's Column, Gt. Yarmouth, 30 *passim*.  
 New Ministries and Secretaries Act, 1916, 209.  
 Newall, Flt. Sub-Lieut. F. G., 283.  
 Newcastle air station, 16, 23, 60.  
 Nicholl, Lt.-Col. V., 123, 125, 127, 129 f., 133, 135, 137, 141, 164, 169, 174 f., 181, 200, 203, 253, 260 ff., 271, 283, 365, 377, 384 f., 402, 407 f., 414, 425.  
 Nickols, 2nd Lieut. C. C. G., 370, 387, 402 f.  
 Niemayer, Leut., 302.  
 Night-flying, safety experiments, 161-3.  
 Night-flying grounds, commissioning of, 140.  
 Nivelle, Gen., 146.  
 Nixon, Obs. Sub-Lieut. J. W., 256, 371.  
 Norderney, Ger. air station, 112 ff., 159, 230 f., 301, 328 f., 407, 419.

- Nordholz, Ger. airship sheds at, 114, 121.  
 Nore Defence Flotilla, 39.  
 Nore defences, tested by aircraft, 71.  
 Norman vane (machine-gun) sight, 295 f.  
 North Berwick, 16, 23.  
 North Sea Airship Division (Ger.), 250.  
 North Sea Flight Division (Ger.), 297 n., 384.  
 Northcliffe, Vis., 284.  
 Northrop, Flt. Sub-Lieut. J. C., 179, 192, 236.  
 Norton, Flt. Sub-Lieut. F. A., 370.  
 Notley, C. (P.O.), 102, 125, 133.  
 Nottingham, bombed, 191.  
*Nottingham*, L.Cr., sunk, 183.  
 Nunn, Flt. Lieut. C. S., 175-6, 274.  
 Observation Officer, rank created, 226.  
 Official Secrets Act, 25.  
 Ogilvie, Alec, 123.  
 O'Gorman, Mervyn, 3, 12, 20 f., 23.  
 O'Hagan, Flt. Lieut. H., 140.  
 Oliver, Wing Commr. Douglas A., 48, 103, 169, 174 f., 181, 202 f., 253, 259 f., 271, 281, 385.  
 Oliver, Warr. Off. H. D., 283.  
 Oliver, 2nd Lieut. T. W., 426 n. 2.  
 Osmond, Air Mech., 105.  
 Ostende, 100, 168, 382.  
 Ostende air station, 403.  
 Otte, Oberleut., 113.  
 Ottley, R.-Ad. Sir C. L., 12.  
 Owen, Lieut. H. G., 371, 412.  
 Owmyb, bombed, 186.  
 Packe, Lieut. R. C., 283, 402 f.  
 Page, Flt. Sub-Lieut. J., 168.  
 Paine, Capt. Sir Godfrey M., R.N., 18 f., 284, 373 f.  
*Panther*, Ger. gunboat, incident at Agadir, 12.  
 Parke, Lieut. W., R.N., 19, 25.  
 Parkhouse, Obs. Sub-Lieut. W. P., 371.  
 Parsons, Sir Charles, 206.  
*Partridge*, T.B.D., sunk, 102.  
 Patrols, naval air, coastal work, 81, 99 ff.; 'Dawn', 'Midday', and 'Sunset', 102; anti-submarine, 177, 313, 359-60, 401; flying-boat, 348 ff., 377 ff., 385-6; 'The Spider Web', 366-7; types of, 369-70.  
 Patterson, Lieut., 394.  
 Paull, Capt. A. H., 283, 394.  
 Pearson, R. F. M., 23, 27 f.  
 Pellatt, Flt. Sub-Lieut. O. W., 370.  
 Pemberton-Billing, N., 205 and n., 206 f.  
 Pembroke, 23.  
 Pembroke W/T station, 152.  
 Pennel, Sub-Lieut. A. N., R.N.V.R., 181.  
 Pennel, Air Mech., 105.  
 Penn-Gaskell, Maj. L. da C., 166.  
 Perrière, Oberleut. von Arnauld de la, 113, 159.  
 Petavel, Prof. J. E., 3.  
 Peterhead W/T station, 152.  
 Petersen, Kap.-leut., 135, 166, 171, 190.  
 Pevensey W/T station, 152.  
 Phillip, Ldg. Mech., 129.  
 Photographic sections, formation of, 152.  
 Pigeons, carrier, used in aircraft, 34, 109, 264, 267, 391; No. N.U.R.P./17/F. 16331, 270.  
 Pigot, Capt. R., R.F.C., 62.  
 Plaskett, Lieut. W. R., 413.  
 Platen-Hallermund, Kap.-leut. Graf von, 121 f.  
 Plowman, Obs. Sub-Lieut. S., 371.  
 Plymouth, 16, 23.  
 Pohl, Ad. von, 163, 305 n. 3.  
 Pole, Flt. Sub-Lieut. A. D., 370.  
 Pollock, Lieut. W., R.N.V.R., 283.  
 Pooley, Ldg. Mech. C., 102.  
 Porte, Lt.-Col. J. C., 213 f., 290, 292, 392.  
 Portsmouth, 16, 23.  
 Potsdam, Ger. air station, 328.  
 Potter, Flt. Sub-Lieut. H. F., 283.  
 Potter, Ensign, U.S.N., 383.  
 Potter's Bar, *L.* 31 brought down at, 192.  
 Powell, Lieut. H. E., R.N.V.R., 256.  
 Prawle Point W/T station, 152.  
 Prendergast, Lieut. H. K., 407, 412.  
 Preston, Lieut. K. B., 426 n. 2.

- Prizes, Law of, 305.  
 Proelss, Korp.-kap., 279, 407, 415, 417.  
 Pulham airship station, 419, 428.  
 Pulling, Flt. Lieut. E. L., 173, 180,  
     187 ff., 197 f., 236.  
 Purfleet, *L.* 15 hit at, 172.  
 Puschmann, Ger. sailor, 113.  
 'Pusher' and 'Tractor' machines com-  
     pared for machine-gun adaptability,  
     67-8.  
 Pustau, Kap. von, 93.  
 Putzig, Ger. air station, 90, 92.  
 Pyott, 2nd Lieut. I. V., 196.
- 'Q-boats', 306.  
*Quest*, motor-boat, 39.
- Radcliffe, Air Mech., 367.  
 Raleigh, Maj. G. H., 80.  
 Raleigh, Sir Walter, 290.  
 Ramsgate, bombed, 250.  
 Randall, Eng.-Lieut. C. J., R.N., 19.  
 Rank titles and dress, R.N.A.S., 75-6.  
 Ranken, Eng.-Commr. F., R.N., 142.  
 Ranken darts, used against airships,  
     142-3.  
 Rathborne, Lieut. C. E. H., R.M.L.I.,  
     48.  
*Raven II*, aircraft-carrier, 281.  
 Rayleigh, Rt. Hon. Lord, 3.  
 Raymond, Pte. (W/T), 282, 394.  
 Reconnaissance, air, experiments in naval  
     manceuvres, 47 ff.; by Zeppelins,  
     183-4, 229-30.  
*Redoubt*, T.B.D., lighter-towing by, 415.  
 Reeves, Flt. Sub-Lieut. A. A., 169, 173.  
 Reid, Pte. ('E'), 394, 398.  
 Reims, flying meeting (1909), 6; (1911),  
     7.  
 Retford, East, bombed, 186.  
 Reuter, Ad. von, 281.  
 Rhyl W/T station, 152.  
 Rice, Commr., 75.  
 Richardson, Lieut. H. C., U.S.N.,  
     213 n.  
 Ridewood, Sub-Lieut. V. H., R.N.V.R.,  
     181.  
 Ridley, 2nd Lieut. C. A., 172.  
 Riley, Eng.-Lieut. E. W., 69.
- Rimer, Flt. Sub-Lieut. A. L., 283.  
 Rischbeith, Flt. Sub-Lieut. C. R., 256.  
 Risk, Sqdn. Commr. C. E., 77, 100.  
*Riviera*, seaplane-carrier, 100, 112, 158.  
 Robertson, Lt.-Col. E. D. M., 392 f.,  
     400.  
 Robinson, Flt. Sub-Lieut. A. N., 181.  
 Robinson, W. A., 373.  
 Robinson, Lieut. W. Leefe, R.F.C.,  
     139 n., 185.  
 Rockford night-flying ground, 140.  
 Roe, Ensign J. J., U.S.N., 388 ff., 399.  
 Rolls, Air Mech., 237.  
 Rolls Royce & Co., Ltd., 110, 216.  
 Rose, Warr. Off. J. W., 283.  
 Rose, C.P.O., 182, 189.  
 Ross Carberry W/T station, 152.  
 Rosyth, 14.  
 Rothermere, Vis., 373 f.  
 Rouzet, Lucien, 42 f.  
 Rouzet W/T transmitter, 88, 225.  
 Royal Aero Club, 6 ff., 11.  
 Royal Air Force, formation of, 373 ff.  
 Royal Aircraft Factory, Farnborough,  
     14 f., 64, 74, 84, 110, 206 f.  
 Royal Flying Corps, creation of, 12;  
     renamed (with R.N.A.S.) the Royal  
     Air Force (q.v.), 370.  
*Military Wing*, formation of, 15 ff.;  
     coastal patrol work, 99.  
*Naval Wing*, formation of, 15 ff.; at  
     Weymouth review, 19-20; W/T  
     experiments, 21-2, 42-5, 66; in  
     army manceuvres, 22-3; duties and  
     functions, 24, 72; strength (1912),  
     26, (1913), 40, (1914), 70 ff.; in  
     naval manceuvres, 46 ff.; individual  
     research encouraged, 59; experi-  
     mental work, 63-5; machine-guns  
     in aircraft, 66-8; renamed Royal  
     Naval Air Service (q.v.), 75.  
 Royal Naval Air Service, ranks and dress,  
     75-6; at Spithead review, 76 ff.;  
     strength and condition Aug. 1914,  
     81 ff.; coastal patrol work, 99 ff.;  
     squadrons sent to Anvers, 100; identi-  
     ty marks, 106, 140; supply prob-  
     lems, 110-11, 152-4, 210, 287 ff.;  
     reorganization, 145-6; policy and  
     progress, 149 ff.; machines used in

- 1916, 210 ff.; flying-boat developments, 213-15; engine production, 215 ff.; armament development, 218 ff., 294-6; training of personnel, 225-6; equipment 1917, 287; engines used 1917-18, 293-4; anti-submarine activities, 312-15; renamed (with R.F.C.) the Royal Air Force (q.v.), 370.
- Royal Naval Division, sent to Anvers, 100.
- Royal Ordnance Factory, 151.
- Rubery-Owen bomb release gear, 87.
- Ruel, S.S., sunk, 306.
- Russell, Pte. (W/T), 394.
- Rutland, Flt. Lieut. F. J., 177.
- Samson, Lt.-Col. C. R., 6 f., 11 ff., 18 ff., 48 f., 55, 63, 71 f., 78 f., 85, 100, 280 ff., 362, 366 f., 370, 377, 384, 386, 392 ff., 402, 415.
- Sandford, Flt. Sub-Lieut. F. E., 141.
- Sandwich W/T station, 152.
- Saundby, Capt. R. H. M. S., 251.
- Scapa Flow air station, 23, 79, 103, 106, 169.
- Scarff, Warr. Off. F. W., R.N., 19, 150, 220.
- Scarff Socket and Pillar Mounting, 150-1, 219; Ring Mountings, 151, 219.
- Scarff-Dibowski interrupter gear, 220.
- Scarlett, Capt. F. R., R.N., 62, 99, 105, 145.
- Scarrisbrick, Lieut. A., R.N.V.R., 371.
- Scheer, Ad. R., 107, 163 f., 167, 170, 172, 182, 184, 193 f., 229, 307, 381 f., 414.
- Scheurlen, Oberleut., 401.
- Schiller, Oberleut., 231.
- Schirpitz, Oberleut., 191.
- Schneider Trophy Race, 147.
- Schüler, Leut., 302.
- Schütze, Korr.-kap., 250, 252.
- Schütze, Oberleut., 278 n.
- Schwander, Kap.-leut., 279 f.
- Schwann, Commr. Oliver, R.N., 3, 9, 11 f., 18 f.
- Scott, Ad. Sir Percy, 132.
- Scott, Lieut. U.S.N., 87.
- Scott-Moncrieff, Brig.-Gen. G. K., 12.
- Scouts, Boy, as messengers and signallers, 102.
- Seaplane-carriers, 126-7.
- Seaplanes, and aeroplanes, differences in flying, 31-4; design problems, 58; in R.N.A.S. Aug. 1914, 82; standardization policy, 86; German makes in 1914, 94; the flying-boat (q.v.), 212-15; the aerial combat of June 1918, 394 ff.; co-operation with naval forces at Helgoland, 415 ff.
- TYPES:
- Boat*, 212-15; 'A.D.', 214-15; *Curtiss America*, 212-14; 'F' (Felixstowe), 214; *F.B.A.*, 215; *Norman Thompson*, 215; *White and Thompson*, 215.
- Float*: Avro, 11; Borel, 41; Caudron, 41; Fairey IIIc, 290; Fairey Campania, 211-12; Farman, 41, 57, 66, 71 f., 77, 148; Short, 13, 41, 56, 85 f., 139, 147, 211, 290, 367-8; Sopwith biplane, 48; Sopwith with Schneider, 147-8, 369; Wight, 86, 147.
- See also* Flying-boats.
- Seddin, Ger. air station, 328.
- Seddon, Sqdn. Commr. J. W., 19, 25, 48, 77.
- Sedgeford night landing-ground, 128, 140.
- Seely, Col. the Rt. Hon. J. E. B., 12, 15.
- Seerappen, Ger. air station, 328.
- Semphill, Sqdn. Commr. the Master of, 259.
- Serajevo, 79.
- Seydlitz*, Ger. B.Cr., 106 f.; mined, 173.
- Sharpe, Chief Art.-Eng., R.N., 3.
- Shaw, Dr. W. N., 3.
- Sheerness, 15.
- Sheerness Naval Depot, Naval Wing head-quarters, 62.
- Shepherd, Flt. Sub-Lieut. P. G., 256, 280.
- Sheringham, bombed, 122.
- Shoppee, Flt. Lieut. L. C., 256.
- Short Bros., 7 ff., 11, 211.
- Short, Horace, 7, 14.

- Short, Oswald, 12.  
 Shortt, Edward, 206.  
 Shuttlar, C.P.O., 102.  
 Siddons-Wilson, Sub-Lieut. A. E., R.N.V.R., 181.  
 Simpson, Flt. Sub-Lieut. G. H., 202.  
 Sinn Fein rebellion, 172.  
 Sippe, S. V., 11.  
 Sitwell, Flt. Lieut. W. G., 65 f., 73, 79, 101.  
 Skegness, 100.  
 Skerries (Drogheda) W/T station, 152.  
 Skinningrove, bombed, 138.  
 Smart, Flt. Sub-Lieut. B. A., 299 n. 1.  
 Smith, Flt. Lieut. Chichester H., 123, 125, 127, 133, 135, 141, 165, 174 f.  
 Smith, 2nd Lieut. C. H., 426 n. 2.  
 Smith, Flt. Sub-Lieut. H. B., 181.  
 Smith-Dorrien, Gen. Sir Horace, 206.  
 Smuts, Lt.-Gen. J. C., 286.  
 Smyth-Piggott, Flt. Commr. J. R. W., 135.  
 Sole, Capt. A. H., 426 n. 2.  
 Sopwith Aviation Co., Ltd., 147, 210 f.  
 Sopwith, T. O. M., 14, 212.  
 Sopwith-Kauper interrupter gear, 220.  
 Sorley, Capt. R., 407.  
 Southend, bombed, 127.  
 Sowrey, 2nd Lieut. F., 190.  
 S.P.G. bullet, 223.  
 Spich, Ger. airship training base, 329.  
 Spickernell, Flt. Sub-Lieut. R., 139.  
 'Spider Web, The', anti-submarine patrol, 366-7.  
 Spithead Naval Review, 76 ff.  
 Sproat, Capt. C. B., 407, 409 n. 1, 412.  
 Stabdon, Kap.-leut., 166, 279.  
 Staddon, Warr. Off. L. R., R.N., 65, 101, 181.  
 Stallard, Lieut. G. W., 407, 413.  
 Steenbrugge, 168.  
 Stein, von, Ger. engineer, 159.  
 Stelling, Kap.-leut., 407.  
 Sterling Telephone Co., 151.  
 Sterling W/T set, 151.  
 Stevens, Pte. ('E'), 394.  
 Stewart, Maj. H., 350, 361 n. 4, 377, 380 f.  
 Stocks, Flt. Sub-Lieut. L., 283.  
 Stone, G. W., 73.
- Storr, Lt.-Col. L., 205.  
 Stoward, Air Mech. A., 102.  
*Strassburg*, Ger. L.Cr., 107.  
 Strasser, Fregattenkap. Peter, 90, 121, 123 f., 132, 135, 166, 193, 248 n., 273, 280, 378, 407, 409, 414.  
 Stratton, Air Mech. G., 102.  
 Sturdee, V.-Ad. Sir Doveton, 185.  
 Submarines, detection from the air, experiments, 14; measures against, 306 ff.; limitations of action, 308-9; German types, 309-11; aircraft activities against, 312-15.  
 Sueter, Capt. Murray F., R.N., 3, 11, 15, 18 ff., 23 ff., 28, 76, 146, 205.  
 Sunbeam Motor Car Co., Ltd., 110, 216.  
 Superintendent of Airship Construction, 146.  
 Supermarine Aviation Co., Ltd., 215.  
*Sussex*, S.S., sunk, 306 f.  
 Sydenham, Lord, 208.  
 Sykes, Capt. F. H., 18.  
 Sykes, Maj.-Gen. F. M., 374.  
 Synchronizing gears for machine-guns, 150, 219-23, 294; 'B' type, 294; 'C', 294; 'C. C.', 223. *See also* Interrupter gears.  
 Talbot, Lieut. C. P., 3, 10.  
 Tarper, Ass.-Paymr. A. H., R.N.R., 283.  
 Taverner, Pte. (G/L), 394.  
 Tegel, Ger. airship school, 329.  
 Tempest, 2nd Lieut. W. J., 192.  
 Tempsky, Oberleut. von, 300.  
 Tennant, H. J., 206 f.  
 Terschelling Island, patrols to, 349-51.  
 Teulon, Ensign, U.S.N., 401.  
 Thetford aerodrome, 191; bombed, 180.  
 Thompson, Sub-Lieut. D. R. W., R.N.V.R., 181.  
 Thompson, Flt. Sub-Lieut. E. B., 175, 181.  
 Thompson, Flt. Sub-Lieut. E. G. F., 256.  
 Thompson, Lieut. Hyde, 85.  
 Thompson, P.O.Tel., 245 f., 254, 283, 349, 359.  
 Thompson, Air Mech., 260, 265.

- Thompson Bennett & Co., Ltd., 111.  
 Thorpe, Warr. Off. E. F., 283, 362.  
 Tomkinson, Flt. Lieut., 103.  
 Tompkins, Lieut., 413.  
 Tondern, Ger. airship station, 172, 273, 328, 407; bombed, 403; operations against, 176.  
 Torpedo-carrying aircraft, German development, 233-5.  
 Towers, Lieut. J. H., U.S.N., 213.  
 'Tractor' and 'Pusher' machines compared for machine-gun adaptability, 67-8.  
 Travers, Flt. Commr., 78.  
 Trenchard, Maj.-Gen. Sir H., 373 f.  
 Trewin, Obs. Lieut. G. S., 177, 259 ff.  
 Tschirschky, Oberleut. von, 156, 230.  
 Tudor, R.-Ad. F. C. T., 208.  
 Twelvetree, Ldg. Mech. F. H. H., 102.  
 Tyrwhitt, V.-Ad. Sir Reginald, 106, 108, 170, 172, 183 f., 415 f., 427.  
*U. 20*, Ger. submarine, 306.  
*U.B. 29*, Ger. submarine, 306.  
 Universal Aviation Company, Ltd., 8.  
 Unwin, Maj. E. F., 166.  
 Upavon, Central Flying School, 17, 26.  
 Usborne, Wing Commr. N. F., 3, 10, 19, 23, 168 f.  
 Vaughan-Lee, R.-Ad. C. L., 146, 205, 208.  
 Vendôme air training station, 226.  
 Véry pistols, 100.  
 Vickers Sons & Maxim, Ltd., 2 f., 9, 40, 220.  
 Vickers interrupter gear, 220.  
 Vincent, Capt. F. J., 426 n. 2.  
*Vindex*, seaplane-carrier, 172, 299 n. 3.  
 Vivian, Capt. G. W., R.N., 38, 48.  
*Von der Tann*, Ger. B.Cr., 106 f.  
 Wakefield, bombed, 196.  
 Walker, Flt. Commr. F. W., 173, 202, 240, 274, 349 ff.  
 Walker, Ldg. Mech., 254, 260, 265, 280, 351.  
 Walker, Fliegerhauptmann, 400.  
 Walmer, bombed, 171.  
 Walter, 2nd Lieut., R.N., 426 n. 2.  
 Wanamaker, Rodman, 213.  
 Wanklyn, Kenneth, 123.  
 Wanstead Flats, bombed, 136.  
 Warneford, Flt. Sub-Lieut. R. A. J., 129 f.  
 Washington, Flt. Sub-Lieut. F. P. L., 202.  
 Watkins, 2nd Lieut. L. P., 251.  
 Wedel, Oberleut., 159.  
 Weir, Sir William, 284, 287 f., 373.  
 Wells, Staff Surg. H. V., R.N., 19.  
 Wemp, Flt. Sub-Lieut. B. S., 175.  
 Wenke, Oberleut., 135 f.  
 Werner, Oberleut., 193.  
 West, Pte., 380.  
*Westfalen*, Ger. B., torpedoed, 183.  
 Westgate air station, 81, 88, 99, 110, 377, 403; the Short seaplane adventure, 242-5.  
 Weymouth, 23.  
 Whale Island, 71.  
 Whatling, V. F. (C.P.O.), 102, 237 ff., 242, 280.  
 White, Mr., co-inventor of G.R.W. Wheel Float Attachment, 69.  
 Whitmore, Warr. Off. F. H., 283.  
 Wild, Flt. Sub-Lieut. H., 202.  
 Wildeshausen, Ger. air station, 328.  
*Wildfire*, H.M.S., 7.  
 Williams, Flt. Sub-Lieut. W. T. S., 141.  
 Williamson, Lieut. H. A., R.N., 13 f., 66, 101.  
 Williams night landing-ground, bombed, 192.  
 Willows, T. E., 24.  
 Wills, Obs. Sub-Lieut. F. L., 371.  
 Wilson, Flt. Lieut. J. P., 130.  
 Wilson, Lieut. L. W., 426 n. 2.  
 Wireless Telegraphy, adapted to naval aircraft, experiments, 21-2, 42-5, 66, 87-8; Sterling set, 151-2; erection of Directional Stations, 151-2; Rouzet set, 225; ground directional sets, 225.  
 Withy, Ass.-Paymr. S. H., R.N.R., 371.  
 Witte, Körv.-kap., 301.  
 Wittmundhaven, Ger. air station, 273, 328.  
 Wobeser, Hauptmann von, 136.  
 Wood, Flt. Lieut. C. E., 137, 141, 164-5, 174.

Wood, Flt. Sub-Lieut. T. G. C., 192, 202.  
 Woodbridge, bombed, 136.  
 Woodcock, Lieut. H. L., 19, 23.  
 Woolwich Arsenal, 64, 87, 119, 223.  
 Workman bomb sight, 87.  
 Wright Bros., 1, 6.  
 Wright, Air Mech. G. O., 242.  
 Wright, Maurice, 123.

Yare, River, 30.  
 Yarmouth, Great, bombarded, 106, 174 ff., 348; bombed, 186.  
 Yarmouth, Great, air station, site advantages and disadvantages, 28 ff.; early staff and equipment, 34 ff.; in naval manœuvres (1913), 48 ff.; takes over Coastguard Service, 62-3; launching problems, 68-70; in Spithead Naval Review, 76 ff.; 'air-ship-plane' experiments, 142, 168-9; night-flying safety experiments, 161-3; activities during naval attacks, 170-1, 174-5, 184, 194, 282; anti-submarine patrols, 177, 182, 253, 271, 281, 359-60, 367; first Zeppelin (*L. 21*) destroyed, 197-200; high standard of personnel, 203; engine troubles, 216-18; *L. 22* destroyed, 237-8; the 'Striking Force', 257; the *N. 8666* adventure, 260 ff.; aerial combats, 260 ff., 271, 362 ff., 388-91, 394 ff., 401-6, 420-1 *passim*; attacks on submarines, 280, 386-8, 401; flying-boat patrols—the *F. 2a*, 348 ff., 377 ff., 385 ff.; reorganization under Royal Air Force, 377; loss of the *N. 8660*, 388-91; flying

from lighters, 392-4; loss of the *F. 2a* *N. 4305*, 403-6; *L. 70* destroyed, 409-10; *L. 53* destroyed, 415; Helgoland Bight operations, 415 ff.; *L. 53* destroyed, 417-18; escorting of surrendered submarines, 427-8; disbandment, 428-9.

Air raids, activities during, 125, 127, 135 ff., 162 ff., 173-4, 179-81, 187 ff., 197 ff., 240 ff., 274-5, 378-9, 408 ff.

Machines in use 1913, 65; 1914, 104; 1915, 146-9; 1916, 202; 1917, 289-93; 1918, 371-2.

Reports (daily) and records, 72-3, 102-3, 123, 128-9, 137, 178, 182, 236, 360-1, 421-4.

Strength, end of 1913, 65; Aug.-Sept. 1914, 101-2, 104; Dec. 1914, 110; Aug. 1915, 134; Dec. 1915, 141; Aug. 1916, 181-2; Dec. 1916, 202; Aug. 1917, 256-7; Dec. 1917, 283; Mar. 1918, 370; Aug. 1918, 407.

*Yorck*, Ger. Cr., mined, 108.

Young, Capt. T. V., 388 ff., 394.

Zahm, Prof., 10.

Zeebrugge, Ger. air station, 112 f., 159, 230 f., 302, 383, 386, 400, 403, 406.

Zeebrugge Mole, 384; blocking of, 382-3.

Zeebrugge Torpedo-Plane Flight (Ger.), 235, 302.

Zeiss bomb sight, 232.

Zeppelin, Graf von, 193, 316.

Zeppelins, *see* Airships; German Air Service.

30 VINTAGE  
AMAZONIA



**PRINTED IN ENGLAND AT THE UNIVERSITY PRESS, OXFORD  
BY JOHN JOHNSON, PRINTER TO THE UNIVERSITY**





THIS BOOK IS DUE ON THE LAST DATE  
STAMPED BELOW

**AN INITIAL FINE OF 25 CENTS**

WILL BE ASSESSED FOR FAILURE TO RETURN  
THIS BOOK ON THE DATE DUE. THE PENALTY  
WILL INCREASE TO 50 CENTS ON THE FOURTH  
DAY AND TO \$1.00 ON THE SEVENTH DAY  
OVERDUE.

APR 8 1934

5Jun'56 LT

MAY 31 2005

MAY 27 1956 LU

UC INTERLIBRARY LOAN

JAN 25 1986

UNIV. OF CALIF., BERK.

UC INTERLIBRARY LOAN

MAR 23 1986

UNIV. OF CALIF., BERK.

LD 21-100m-7,33

701707

D 602  
S 6

UNIVERSITY OF CALIFORNIA LIBRARY

